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THE GRASSLANDS OF NEW ZEALAND.

SERIES II. NORTH ISLAND HILL COUNTRY.

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GRASSES AND CLOVERS FOR HILL COUNTRY—*continued.*

(5.) Paspalum *(Paspalum dilatatum).*

IN the North Island, over the major portion of the Auckland Province, paspalum occupies a position among the permanent-pasture species corresponding somewhat to that held by cocksfoot farther south. Paspalum, however, so far as soil-types are concerned, has a much wider range than cocksfoot. It will thrive on extremely wet soils, such as in a waterlogged undrained swamp, or on areas subject to periodical inundation even by brackish water; on dry sands and light open volcanic soils; on loose unconsolidated soils, such as peat swamps; and on heavy consolidated clays—even the heaviest of the northern gum-land type. It tolerates shady conditions well, but also persists on exposed sunny knolls. It has a very wide range of adaptability so far as the quality of a soil is concerned. Normally it is a demander of a high state of soil-fertility, ranking in this respect even above cocksfoot, but in the case of paspalum a reduction in fertility does not lead to an opening-up of the pasture sward; the turf remains closed even though the production of herbage may fall away almost to nothing. Paspalum is one of the greatest pioneering grasses for many of the rougher soil-types, where in the ordinary course of events it would take years of preparation of the land to bring about conditions favourable for persistence and thriving of the better-class English grasses.

In this article it is the intention to deal more specifically with paspalum in relation to the hill country, but many of the principles that apply to hill-country grasslands apply equally well to the low-land soils so far as the intrinsic value and management of the pasture plants are concerned.

The two big factors that limit the value and wholesale application of paspalum in New Zealand are (1) its high soil-fertility requirement, and (2) its rather high temperature requirement.

As before stated, in fertility requirement paspalum ranks above cocksfoot, and as a matter of fact it comes well up to perennial rye-grass and meadow-foxtail standard in this respect; but these two grasses when sown on the same rich soil along with paspalum are easily able to maintain a dominant position in the pasture, owing to their seasonal-growth range being much wider than is that of paspalum. In such pastures, however, there may frequently arise a summer seasonal paspalum dominance, particularly so when the pasture is allowed to get away rank. It is on soils, however, just not quite good enough for perennial rye-grass — that is, on typical cocksfoot country — that paspalum shows up as a marked dominant in the sward (Fig. 88). So dominant, in fact, may paspalum become, particularly under poor utilization, that all other associate species sown virtually disappear entirely from the pasture. The writer claims that under most soil conditions it is possible to keep a mixed association, and such should be the aim of every farmer on soils capable of growing paspalum (Fig. 89). One hears so often of the danger of paspalum getting away and taking complete possession of the land; but because a grass produces so much feed that utilization problems arise, demanding skill on the part of the farmer successfully to deal with the big bulk produced, surely this is no reason why that grass should be condemned! Rather must one put down that state to a fault in the pasture-management rather than to a defect of the grass itself.

Normally paspalum is an extremely high producer—in fact, the writer would say offhand that the possibilities for production are greater in paspalum than in any other grass one could mention. The great disadvantage with paspalum, however, is that its yield is not spread evenly over the twelve months, as is the case with perennial rye-grass. Then again, perennial rye-grass is an English grass, and farmers in New Zealand do pride themselves on being able to say that their pasture consists solely of English grasses, irrespective of how poorly such grasses may be doing.

In regard to the rather long dormant period of paspalum, this may be turned to quite good advantage, for it is possible during this period to stimulate the associate species and thus to maintain a mixed association. Farmers in colder areas are generally louder in their condemnation of paspalum than is the case in warmer districts, for the reason, they say, that paspalum is good only for a few months in the summer. As a matter of fact, it appears to the writer that under conditions too cold for paspalum to thrive only in the heat of summer there should be no difficulty whatsoever in keeping a mixed association throughout the major portion of the year. This is particularly true of most areas within the Auckland Land District (South Auckland). In this district the thing that should decide whether or not paspalum should be included in the permanent grassland mixture is whether during the summer there is a sufficiency of growth from this grass to warrant it. The more the paspalum is inclined to get away rank in the summer, and the more inclined the grass is to spread from seed, the more should it be used as a

constituent of permanent grassland. The fact that paspalum has a longer winter dormant period farther south than it has in the north should not preclude its use in mixtures. Under proper management and high fertility upkeep paspalum would not become dominant over any area where its dormant period is of long duration, and, as a matter of fact, the longer the dormant period of paspalum the easier it is to keep associated with it other grasses and clovers.

With paspalum this mixed association is of great importance, whether it be on the hill or on the flat, and too much stress cannot be laid on the necessity of so managing conditions that pure paspalum pasture is avoided. Increasing dominance of paspalum, resulting finally in pure paspalum pastures, is almost entirely due to management. In two ways do the associate species become eliminated from or reduced in the sward: (1) By an overdevelopment of the paspalum

FIG. 88. PASPALUM ON HILL COUNTRY, NORTH AUCKLAND (KAIHU VALLEY), GROWING STRONGLY ON LAND NOT GOOD ENOUGH FOR RYE-GRASS.

The paspalum here has beaten cocksfoot for the position of dominant, a fair indication that paspalum is capable of producing on this soil more feed than cocksfoot could under the same conditions. Compare with Fig. 64 of this series.

[Photo by E. Bruce Levy.

growth during its peak period of production, resulting in a smothering-out of the essential bottom grasses and clovers (Fig. 90); (2) by a reduction of soil-fertility bringing about conditions too poor for the associate species to thrive, and resulting finally in a stunted, matted, sod-bound state of the paspalum itself (Fig. 91). Paspalum, like cocksfoot, is essentially a top grass. When allowed to get away it produces a great bulk of leafy foliage, which casts so dense a shade in the bottom of the pasture that all bottom grasses and clovers—perennial rye-grass, crested dogstail, white clover, &c.—are smothered out.

Lotus major stands the cover to some extent, as also do certain annuals, particularly Lotus hispidus and subterranean clover. These

FIG. 89. PASPALUM, WELL UTILIZED, RETAINING A MIXED ASSOCIATION (RUAKURA).

Under good utilization conditions it is quite possible to keep a mixed pasture. The richer the soil the better the type of associate species that persist and thrive. Here subterranean clover, cocksfoot, crested dogstail, and a little rye-grass are nicely mixed in with the paspalum. [*Photo by E. Bruce Levy.*

FIG. 90. PASPALUM GROWTH ALLOWED TO GET AWAY RANK (WAIROA, HAWKE'S BAY).

Under poor utilization paspalum, where conditions are suitable for its growth, creates so much shade in the bottom of the pasture that virtually all associate species are smothered out and pure paspalum pastures result.

[*Photo by W. D. Reid*

annual clovers are very early spring seeders, and for the most part, particularly on the poorer soils, have made their seasonal growth and have ripened their seed before rank growth of paspalum commences in the summer (Fig. 92). The seeds of these annuals lie dormant in the dense shade of the rank paspalum growth until this ceases and is cleaned up in the autumn, when once more the annuals establish and furnish quite good feed throughout the winter and early spring. On high-class soils, however, better associate grasses than these annual clovers should be the aim of every paspalum-farmer, and it may be repeated that on the average-quality soils ranging up to the best-quality soils it is possible to so manage the paspalum pasture that perennial rye-grass, crested dogstail, and white clover can be retained indefinitely as associate species to paspalum. It is of little value having cocksfoot associated with paspalum in North Auckland, for the seasonal growth of this grass is not essentially different from that of paspalum. In seed-mixtures, however, some cocksfoot is generally included, and this practice is certainly sound south of Auckland City.

So far as the soil-fertility requirement of paspalum is concerned, and the bearing soil-fertility has on the associate species, it has been pointed out in previous articles that rye-grass, cocksfoot, crested dogstail, white clover, &c., in themselves demand a high state of soil-fertility apart from being asked to associate well with a ravenous grass like paspalum. In growth-form paspalum is a deep-rooting grass, and its crown and rooting system is below ground. Artificial manure applied as a top-dressing will become available to surface-feeding grasses and clovers—rye-grass, cocksfoot, white clover, &c.—sooner than it will in the case of paspalum. Hence top-dressing paspalum pastures tends to a rapid increase of associate species, provided always the paspalum growth is not rank.

A reduction in fertility is generally reflected in a dwindling of the associate grasses and clovers, and in a considerable reduction in the amount of growth produced by the paspalum itself. The foliage becomes stunted, often taking on quite a purplish tinge, and at this stage is quite unpalatable to stock. Owing, however, to the growth-form of the plant there does not result, as in the case of tussock-forming grasses like cocksfoot, rye-grass, &c., an opening-up of the pasture turf due to contraction in size of the tussock. Paspalum is a close mat-former, the plant spreading outward to form this mat by the production of short tillers arising from the underground crown. Under hard conditions this crown appears to work up above ground, and the tillers then arise at ground-level from the under-surface of the old stunted shoots above. In either case the ultimate result of a depletion of soil-fertility is the formation of a more or less pure turf so stunted and sod-bound that virtually no feed is produced from the paspalum itself, and practically the conditions are too hard for any associate species to thrive (Fig. 91).

This sod-bound state in paspalum is an argument often put forward against the use of the grass, but the writer must again affirm that this state is but the reflex of the conditions existing in the soil upon which the paspalum is growing. Paspalum will not become sod-bound while a plentiful supply of plant-food remains available in or is annually

FIG. 91. SOD-BOUND PASPALUM TURF SHOWING FULL SEASON'S GROWTH (NORTH AUCKLAND).

Here a reduction in fertility has resulted in a dying-out of the associate species, and a dwindling of paspalum to a low producing and most unpalatable plant. Note that although paspalum has dwindled extremely there is no opening up of turf.

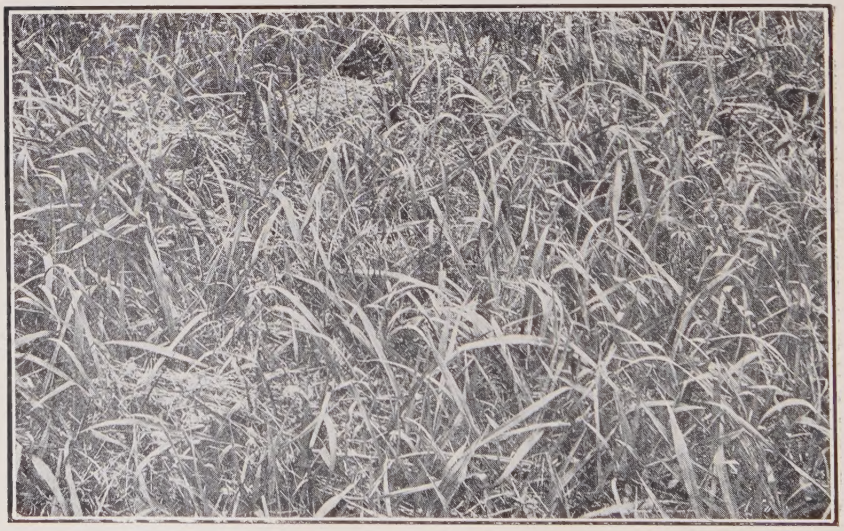

FIG. 92. PASPALUM AFTERMATH FROM HAY CROP HARVESTED IN DECEMBER.

From this area (a poor gum-land soil-type, North Auckland) a heavy crop of Lotus hispidus was taken off before Christmas, and the paspalum is now seen coming away to take up the running over the dormant period of this annual.

[*Photos by E. Bruce Levy.*

applied to the soil. Just as the dwindling and running-out of rye-grass, cocksfoot, &c., from the pasture is an indication of starvation conditions, so, too, the matting or sod-binding of paspalum indicates a shortage of the food-supply in the soil. In the case of paspalum pasture, perhaps the state is accentuated to some extent by the fact that when the sod-bound stage is reached the thatch-like cover formed by the turf over the soil precludes easy access of water and also of free air, thus preventing these natural ameliorating and recuperating influences from operating. The good effect from heavy tripod-harrowing or disking of sod-bound paspalum pastures is due largely to the aerating effect these processes have on the soil. In themselves, however, the disking or harrowing adds no additional plant-foods to the soil, but simply allows in air and water, which make available otherwise unavailable plant-foods locked up in the soil. This point will be treated a little more fully later on when dealing with permanent grasses for extremely poor soils.

Paspalum is not a suitable grass for poor soils. The fact that it is an extremely high producer under adequate feeding really rules it out as a suitable grass for poor soils, for the reason that a grass when starved is generally of very low palatability. This is no exception in the case of paspalum. Therefore, when dealing with poor soils, which owing to the topography and inaccessibility of the country are not capable of being improved in any way by top-dressing, &c., paspalum should not be sown. On poor soils, however, that can be top-dressed and the fertility built up, provided the climate is suitable, paspalum will return perhaps better than any grass, and the greater the improvement the greater will be the response—for paspalum is truly capable of responding almost to an unlimited degree.

In a sufficiently warm climate, then, where does paspalum come in as an important grassland constituent? Roughly speaking, the writer would say, from the brown-top standard of soil-fertility upwards. On the better class of brown-top country paspalum does quite well, but on the poorer brown-top country and on most danthonia country it is of little permanent value—unless, as before mentioned, top-dressing or other means can be adopted for building up the fertility.

On poor soils paspalum when establishing and spreading out—while it has room to tiller out and to occupy new ground—certainly does seem to be doing all right, beating easily on such soils any individual plants of brown-top or danthonia that it may be associated with (Fig. 93). But it must be borne in mind (as in the case of Poa pratensis, dealt with in the September issue of the *Journal*) that while there is room to tiller, fresh food reserves are being tapped by the out-spreading plant. When the ground has been entirely covered by the plant, and when no fresh food reserves are left untapped, then is the sod-bound, low-production, thatched state reached, with a corresponding falling-off in carrying-capacity. It is the old mistake of putting a high producer on a soil that cannot support it permanently. A bankruptcy must surely follow, and the area will go out of business as a producer until such time as the farmer comes to the rescue with his plough or top-dressing, or else spells the area for some time to allow of natural recuperation by resting, fallowing, &c.

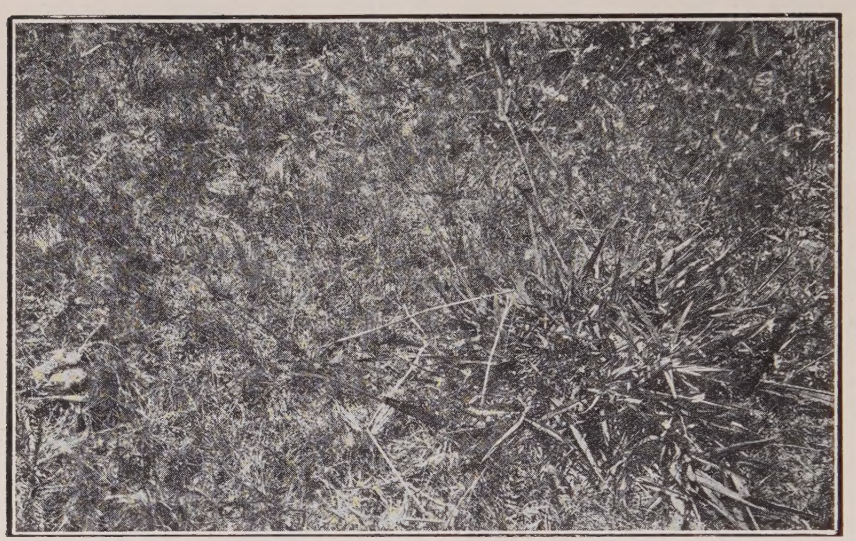

FIG. 93. PASPALUM-PLANT ON RIGHT SPREADING OUT ON POOR SOIL (GUM LANDS, NORTH AUCKLAND).

Paspalum is here established in a Danthonia semiannularis pasture. While the paspalum-plant can tiller out and occupy fresh ground it beats the Danthonia in production, but sod-bound pastures result on poor soils when all the ground is covered.

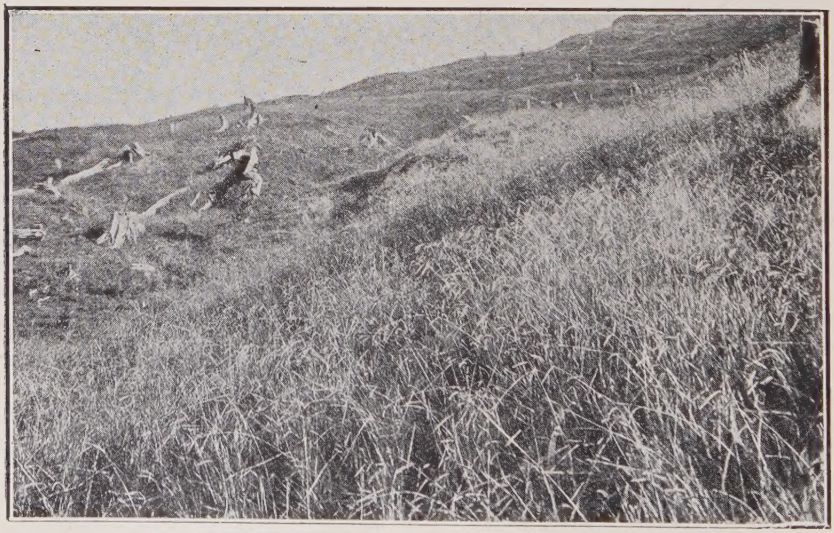

FIG. 94. PASPALUM AS A DOMINANT, NORTH AUCKLAND.

On all the moderately fertile soils of the North the farming of paspalum—full consideration being given to utilization and fertility-upkeep problems—is probably the most remunerative grassland farming in New Zealand.

[*Photos by E. Bruce Levy.*

CLIMATIC RANGE OF PASPALUM IN NEW ZEALAND.

Paspalum is one of the few grasses of economic importance so far introduced into New Zealand that are restricted in their spread by climatic conditions.

Paspalum is widely distributed in the North Auckland Land District, and bids fair to become a dominant over all the better-quality soils of that district (Fig. 94). South of Auckland it is more restricted, but each year is gaining in importance as far south as Te Kuiti (Figs. 95 and 96) and throughout the Waikato, Piako, Tauranga, Matamata, Whakatane, and Opotiki Counties. On the east coast as far south as Napier paspalum is of value (Fig. 90), and on the west coast as far south as New Plymouth, together with odd coastal localities even as far south as Foxton, this grass is well established and is inclined to spread. In the South Island paspalum also thrives quite well along the Sounds country from Picton to Nelson, and thence down the west coast as far south as Hokitika.

From this it will be seen that paspalum is becoming very widely distributed over the more temperate parts, and its range each year seems to be extended. In view of this fact it does seem imperative to have a clean-cut vision of the possibilities of paspalum on all types of country, and further work is needed along the lines of delineating the exact climatic range and the geographical boundaries within which this grass is of economic importance. In North Auckland, where it has now been established for approximately forty years, a very fair knowledge of paspalum can be attained. On the more fertile flats and on the better hill country many stands of paspalum from twenty to thirty years old are still producing well. In fact, wherever there is high soil-fertility no falling-off or sod-binding of paspalum takes place. Over much of that area, where repeated failure to secure permanent grassland by the sowing of the high-class English grasses has been met with, the use of paspalum has economically grassed many thousands of acres that would otherwise be rushes, niggerheads, toetoe, tall fescue, pennyroyal, buttercup, plantain, or other such weeds. Its inclusion also in the original bush-burn sowing has saved many thousands of acres of hill country from reverting to fern and other classes of secondary growth (Figs. 97 and 98). This is due largely to the fact that even where paspalum has fallen off considerably no opening-up of the paspalum turf has taken place, and hence little chance has been afforded secondary growth to become established. On the poorer hill country and on much of the gum lands of the North paspalum has done good work in the past, and will still do good work during the early years of production from these soils. Here, however, without attention being given to maintaining soil-fertility and to building it up as much as possible paspalum will produce well for ten to fifteen years, but will then, having occupied the whole ground-surface, fall off considerably in production and palatability, presenting then the matted, sod-bound state already referred to. The poorer the soil on which the paspalum is sown the sooner will the sod-bound stage—or one may more meaningly express it, the starvation stage—be reached. The writer has seen paspalum when thickly sown becoming sod-bound within three or four years. In fact, scarcely at any stage in such paddocks could one say paspalum was ever producing well, no room being afforded for any plants to become well established and to spread out to reach new zones of untapped plant-food supplies.

FIG. 95. PASPALUM ON HILL COUNTRY, TE KUITI, SOUTH AUCKLAND.

As far south as Te Kuiti paspalum will thrive quite well, and its longer dormant winter period in that situation can be easily overcome by top-dressing, which results in an increase of associate grasses and clovers. These not only throw feed during the dormant period, but through their shelter the paspalum is not so injured by frost, and hence it comes away quicker in the summer.

FIG. 96. TOWARDS THE SOUTHERN LIMIT OF PASPALUM—THE MOKAU RIVER.

On the flat (and richer portion) shown in the photo paspalum does quite well and is spreading naturally from seed. Its spread up the poor slopes, however, is not at all hopeful.

Photos by E. Bruce Levy.

FIG. 97. AREA—TO RIGHT OF FENCE—WHERE PASPALUM WAS INCLUDED IN THE ORIGINAL PRIMARY-BURN SEED-MIXTURE.

This area is now exceedingly well grassed, while on the left of fence, where no paspalum was sown, the land is a solid mass of bracken fern.

FIG. 98. CLOSE VIEW OF PART OF AREA ON RIGHT OF FENCE IN FIG. 97.

Showing good sward of grass, with paspalum dominant, and no sign of any secondary growth. [*Photos by E. Bruce Levy.*

This sod-bound state has been referred to as indicating starvation, the very binding-up of the turf accentuating the trouble by the more or less waterproof and airtight covering that the mat forms. The breaking of this cover or mat to allow free access of air and water, and the increase of soil-fertility by one means or another, are the two essentials to bring back sod-bound paspalum pastures to high production. On the ploughable country the breaking of the turf can be accomplished by the disk, heavy tripod harrows, or, better still, by ploughing the area in fairly narrow furrows, the furrows being set up to overlap one another at a fairly steep angle (Fig. 99). This ploughed area is left in the furrow until such time as fresh paspalum growth makes its appearance within the angle of the furrows. When the growth is a few inches high the area may then be disked and a seed-bed

FIG. 99. RENOVATION OF SOD-BOUND PASPALUM PASTURE BY PLOUGHING.

The breaking of paspalum turf by plough, disk, &c., or by heavy treading by cattle, gives air and water easy access into the soil. Breaking the turf in this way and otherwise increasing soil-fertility are the two essentials to bring sod-bound paspalum pastures back to permanent high production.

[*Photo by E. Bruce Levy.*

prepared for roots, maize, or grass. The paspalum grows strongly along with such crops, and new vigour is put into the plant. This renovating operation, when analysed, is fulfilling the dual purpose mentioned for the satisfactory renovating of sod-bound turfs. By the ploughing, air and water are freely allowed into the soil, and by the turning-under of the turf an increase of fertility takes place, this turf soon rotting and providing quickly available plant-food for the few plants surviving along the edge of the furrow. This supply of plant-food, however, is not lasting, and after the second year, unless top-dressing is carried out, the paspalum takes on a starved appearance once more.

On steep hill country the foregoing methods of breaking the matted turf are not available, and the farmer must utilize to the best of his ability that all-important implement of hill-country management, the cattle beast. By the hoof cultivation possible through the use of this animal the turf may be broken, but the farmer must bear in mind that the actual breaking of the turf allows the entry of air and water only, and paspalum needs something more substantial than these if it is to get back to its former high production. Top-dressing with artificial manures is the most direct method of supply for this food deficiency. Feeding out hay or roots on to the area is also good where practicable, and this also provides keep for the cattle while working on the area to do the necessary poaching. Either hay or roots must be supplied, or else the area to be treated must be spelled for a full growing season so as to accumulate as much roughage as possible by winter-time, in which season this work of hoof cultivation is best performed, the ground then being sufficiently soft for the hoofs to break through the turf. This spelling and conversion of roughage by the full-grown cattle beast increase fertility to a small extent, and feeding out hay or roots gives added fertility increase, but the more direct and more lasting method is a good top-dressing of artificial manures. The point here that the writer wishes to make clear, however, is that paspalum can be brought back to high production from the sod-bound state once attention is given to the breaking of the turf by some implement or by cattle, and to bringing about in one way or another an increase of soil-fertility.

Prevention, of course, is better than cure, and one may feel sure that the farmer when he realizes why paspalum becomes sod-bound will make every effort to keep conditions right so that this high producer can function to its maximum capacity. Paspalum has by many been regarded as a foolproof grass—one that will fossick for itself; one that does not need manure or care of any sort; one to be condemned when it gets out of hand and rank on good country, and to be spurned when it becomes sod-bound on poor country. Paspalum has great potentialities within its climatic range, but it is not foolproof, and it demands for its proper care and management perhaps more skill on the part of the farmer than does any other single pasture or fodder plant that one could name—with perhaps the exception of lucerne. The writer knows of no grass, however, that will more repay the farmer the skill he puts into his grassland farming than will paspalum.

PASPALUM UNDER SHADY AND SECONDARY-GROWTH CONDITIONS.

Paspalum is an extremely good shade-endurer, and will persist strongly within fairly dense secondary growth—bracken fern, hard fern, short manuka, &c. (Fig. 100). It will penetrate into the heart of tussock growths such as rushes, niggerheads, toetoe (*Mariscus*), and tall fescue. Growing thus among these growths it serves as an excellent attraction to stock to work among the fern, &c., and firing the secondary growth does not in the least injure the crown of the paspalum. After the fire, particularly in an early summer burn, the renewed growth of the paspalum is extremely rapid (Fig. 101), and on fairly fertile soils quite a good cover is formed soon after.

Paspalum really fulfils the requirements necessary in a grassland species to economically and effectively deal with secondary growth

FIG. 100. PASPALUM COMPETING SUCCESSFULLY WITH HARD FERN, NORTH AUCKLAND.

Paspalum is here producing sufficient feed to induce stock to work on the area and crush out the fern growth.

FIG. 101. RENEWED PASPALUM GROWTH AFTER A SECONDARY-GROWTH BURN (GUM LANDS, NORTH AUCKLAND).

Paspalum withstands fire extremely well, and when once the plant is established among secondary growth no further seeding of the burn is necessary as far as paspalum is concerned. [*Photos by E. Bruce Levy.*

—that is, it will persist and thrive within shade of moderately tall secondary growth, thus serving as an inducement to stock to work on the area; it will carry a fire well without any injury whatsoever to itself; it comes away rapidly after a fire, and builds up rapidly to form a complete cover. Further, it is not necessary to buy further seed of paspalum once establishment on the area is effected, and thus the regrassing becomes decidedly economical, particularly where the secondary growth is of such a nature that it can be cleared off and destroyed by fire or cattle.

In this work of secondary-growth control, however, paspalum has limitations in two directions: (1) Its recovery after the fire is not rapid on poor soils, and (2) it is limited in its application by its fairly high temperature requirement. In North Auckland on all moderately fertile hill country paspalum has no equal as a controller of secondary growth. The writer has seen areas of bracken fern and hard fern completely controlled by paspalum (Figs. 102 and 103). On one farm in the Paparoa district this was accomplished by first establishing a small 5-acre paddock of paspalum on a ploughable piece of country in the heart of a bracken-fern area. When this paddock was firmly established, and while in full seed, the fence dividing the area from the rest of the fern country was removed and cattle put on. From the paspalum-paddock tracks radiating through the fern were first formed by the cattle using the fern block as a run-off, and along these tracks paspalum soon established itself from seed brought from the area by the cattle themselves. By the growth and spread of the paspalum along the tracks more cattle were worked on the area, and within five or six years most of the bracken fern was wiped out. Distribution of the paspalum-seed was also effected by surface-sowing by hand along the tracks and wherever there were open patches in the fern. These sowings were made at the rate of about 5 lb. of seed per acre of ground sown, and took place in the month of February.

Paspalum is of value not only for the control of bracken fern, hard fern, water-fern, manuka, tall fescue, &c., but also is most promising for the control of blackberry. Blackberry will not thrive with a tight turf of grass about its crown, nor can it spread by layering in a close turf such as paspalum can make. As far south in the Auckland District as Te Awamutu, on peat swamps, may be seen excellent examples of blackberry-control by the use of paspalum. In the east-coast district also, to as far south as Wairoa, the writer feels certain that on the better-quality soils at least, or where top-dressing can be systematically carried out, the establishment of paspalum among any blackberry that may be there is one of the means by which this troublesome secondary growth can be suppressed.

Again, in the case of piripiri a close turf-former like paspalum gives no facilities for the creeping stems of this weed to root and thus to form new plants (see Fig. 31 of this series, *Journal* for November, 1923). Piripiri when kept up off the ground is most susceptible to damage, particularly by grazing cattle. Keeping the creeping stem up off the ground by spelling or by the formation of a close turf and stocking with cattle are the basic principles underlying the control of this weed. Paspalum is a great turf-former, and therein lies its value as a weed-controller apart from the large bulk of feed it is capable of producing.

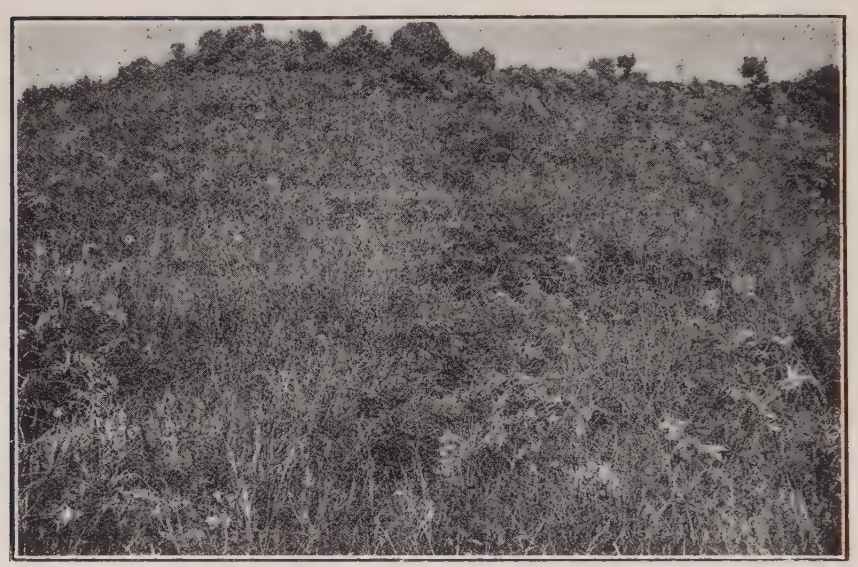

FIG. 102. HILLSIDE AT PAPAROA, NORTH AUCKLAND, WHERE PASPALUM IS GRADUALLY SPREADING INTO THE BRACKEN FERN AS THE LATTER IS CRUSHED BY CATTLE.

No burning was carried out in this case, but seed at the rate of 5 lb. per acre of the land sown was broadcasted along tracks and on the more open patches within the area.

FIG. 103. PASPALUM TURF ON SMALL, FAIRLY FERTILE AREA AT POHOKURA, SHOWING ITS CONTROL OF BRACKEN FERN.

Although this area of paspalum is not large, it gives quite a reliable indication of what paspalum will do on the more fertile and sunny slopes of the Taranaki back-country.

[*Photos by E. Bruce Levy.*

PASPALUM IN PRIMARY AND SECONDARY BURNS.

Paspalum is slow to establish from seed, two or three years often elapsing before much sign of the grass is seen when included in a mixture. Whether in the primary or secondary burn, therefore, this grass cannot be relied on to produce much feed for two years at least. Its growth from this period onwards is controlled largely by the fertility of the soil and the ruling temperature. It establishes quite readily in comparatively difficult places on the burn—on pukahu and other unconsolidated surfaces and on rather hard knolls—and although on these it does not produce much feed, yet it persists there and tends to cover the ground somewhat. In the third and fourth year of the burn paspalum comes in well as a follower on to the rye-grass, functioning in this respect in much the same way as does cocksfoot (Fig. 94). Its greater persistence and wide range of adaptability to varying conditions make it a better grass than cocksfoot on all country suitable for its satisfactory growth. From 2 lb. to 4 lb. of seed per acre is sufficient to include in the primary-burn mixture.

For the secondary-burn mixture within the paspalum climatic range the value of this grass largely depends on the quality of the soil. Paspalum is of such immense value for the control of secondary growth that no effort should be spared to make the soil conditions suitable. Its slowness to establish from seed certainly is a disadvantage, and this precludes ever making this grass a dominant in the mixtures sown. For the early stages of control of secondary growth after the burn some rapidly establishing grass is essential, otherwise the unchecked return of the secondary growth is so rapid that before the slow-germinating species have established from seed they are killed out by the shade formed by the secondary growth.

Paspalum is a good establisher on hard surfaces, being in this respect similar to crested dogstail. As before indicated, in North Auckland quite good establishment of paspalum has been effected by surface-sowing seed on weak grassland turf during the summer and early autumn (Fig. 104). Many farmers prefer spring-time for the sowing, but the writer is of the opinion that if paspalum fails to establish from early autumn sowings then the possibility of it doing well on that soil, even when established in the spring, is very remote. In sowings made in the Whangamomona district in 1924 on the sunny slopes paspalum germinated and came to the one-leaf stage within three weeks of sowing. These sowings were made about the middle of March. On shady slopes in that country up to the present no success has followed the sowing of paspalum. North of Auckland paspalum is usually successful on all aspects, but as far south as Te Kuiti and across to New Plymouth it would seem almost a waste of seed to include it in mixtures for shady slopes and colder aspects.

On very poor country, also, the writer does not recommend paspalum for secondary burns unless top-dressing is possible, and, bearing in mind the economics of top-dressing poor, hard country while there are any better-quality soils not top-dressed on the farm, it looks as though one must be content to leave the poorer and harder country for danthonia and similar low-fertility-demanding plants. The writer would again stress the necessity of recognizing that the high producer must be adequately fed if that plant is to produce a good-quality and highly palatable herbage, and to ensure permanent productivity from

the land on which it is sown. Paspalum is a high producer, and hence is a high-fertility-demanding grass, but owing to its growth-form it can retain possession of the ground to the exclusion of most other plants, even though its yield may fall off to a mere bite of highly unpalatable herbage.

With regard to the amount of seed to include in mixtures for secondary-growth burns, as before stated, paspalum is of no value as a feed-producer for the first or second year. Paspalum falls into a class of pasture plants that are expensive to establish and form a turf by the actual sowing of seed. In the Whangamomona sowings 8 lb. of paspalum was included in certain mixtures, but the feed produced from this heavy sowing has been very small indeed for the two years during which these sowings have been going, and compared with certain other grasses paspalum must be ruled quite out of reckoning so far as a cheap and rapid cover of the ground is concerned.

FIG. 104. PASPALUM ESTABLISHED FROM SEED SURFACE-SOWN ON WEAK TURF (NORTH AUCKLAND).

Even as far south as Whangamomona on the sunny slopes quite good results have been secured, as far as the establishment of paspalum is concerned, by surface-sowing this seed over weak, open turf.

(*Photo by E. Bruce Levy.*

Thus paspalum, along with certain other species, in order to be economically sound as compared with other cheap-establishing species, must have the capacity to spread out vegetatively from the few plants that are established, or else be able to propagate itself by reseeding. The writer is therefore inclined to sow only small quantities of paspalum in secondary-growth burns, and to rely entirely upon the ability of paspalum to spread vegetatively and by reseeding in later years. An amount of 2 lb. per acre for all secondary burns within the climatic range for paspalum is recommended. This small quantity of seed also gives other plants a chance to establish and to hold the ground on poor aspects, thus preventing the spread of paspalum on aspects where it is sure sooner or later to become sod-bound.

DISTEMPER OF DOGS.

CAUSE AND HOME TREATMENT OF THE DISEASE.

D. A. GILL, M.R.C.V.S., D.V.S.M., Wallaceville Veterinary Laboratory.

As distemper has taken considerable toll of the dogs in some parts of New Zealand during the spring of this year, the following information regarding the disease may be of interest and assistance to farmers or others.

For some years past there have been two views held as to the cause of the disease. It is known to be an infection and highly contagious, but research aimed at discovering the actual causative agent was made very difficult by the fact that the disease is generally complicated by another superimposed trouble such as bronchitis, pneumonia, or inflammation of the bowels; so that it was almost impossible to know what were the symptoms of distemper by itself or what course it would run if uncomplicated. There were two main opinions held. One was that the disease was due to a germ known as *Bacillus bronchisepticus canis*, the opinion being based on the fact that from a very high percentage of affected dogs this germ can be obtained, and, further, that symptoms like distemper have sometimes been produced by giving young dogs injections of this germ. The other view was that the *Bacillus bronchisepticus* was only a secondary invader, and that the real cause was what is known as a filter-passing virus. This is an agent which is too small to see with a microscope, but whose presence is known by the fact that fluids containing it can be passed through such fine filters that all visible bacteria are held back, and yet the fluid which comes through the filter is still capable of producing the disease in question if injected into a susceptible animal.

Of late years the latter view has become more and more established, till recently it has been placed on what appears to be an entirely firm foundation by the work of Dunkin and Laidlaw in England. A fund was raised by *The Field* in England some three years ago with the object of getting sufficient money to have the disease thoroughly investigated. Through this it has been possible to rear dogs in absolute isolation, and by so doing to know that the experimental animals are absolutely clean and free from all traces of distemper when experiments are made upon them, so that the real disease, shorn of its complications, has now been studied by the workers mentioned.

Although not the cause of the disease, *Bacillus bronchisepticus* is of considerable importance, owing to its being very widespread (often living harmlessly in the bronchial tubes of healthy dogs) and its ability to attack these tubes, and the lungs also, when the dog's system is weakened and its powers of resistance reduced, as they are during an attack of distemper. One of the features of the disease as it has recently affected dogs in this country has been the frequency of acute bronchitis and pneumonia, which were in all probability due to this secondary invader. It is only reasonable to suppose that if a healthy and susceptible dog comes in contact with another suffering from distemper and a complication he may contract not only distemper but

also the complication, and thus there is a tendency towards a series of cases all showing roughly the same picture.

As far as vaccination against distemper is concerned, there is really no such thing. Vaccines are used, but they are aimed at protecting the animal against the complications that may arise, and not against the actual disease. A dog that has once been attacked by the filter-passing virus of distemper and has recovered from it is immune from further attacks for the rest of its life, but no amount of vaccination with *Bacillus bronchisepticus* or other germs will protect a dog from distemper, though it may be beneficial in warding off dangerous complications.

In some cases nervous symptoms appear when the dog has been ill for two or three weeks. Such symptoms may take the form of a persistent twitching of the muscles or convulsions at more or less short intervals, or, again, the dog may roll over and over on its side persistently. The onset of nervous symptoms such as these is extremely serious, and very few dogs ever recover from them.

SYMPTOMS AND HOME TREATMENT.

Though adult dogs are not immune from attack, the disease is typically one of infancy—just as mumps and measles are in the human subject. Often an attack is so mild as to pass almost unnoticed, the dog merely being a little dull and off his feed for a day or two. The commonest symptom is a discharge from the eyes and nose, which, at first watery, soon becomes thicker and forms a dry yellow crust round the eyes and nostrils. Frequently also there is a slight throaty cough for a day or two. The temperature (normally about 101½° F.) rises sharply at the outset, then about the third day generally falls to nearly normal, and afterwards slowly rises again and may be elevated for some two or three weeks. This is an important point, since frequently a dog looks so much better after the first day or two that he is considered over the trouble, and no further attention is paid to him. Thus, when the temperature rises the second time, an exposure or an amount of fatigue which would do no harm to a healthy dog results in a relapse. It is then that complications such as pneumonia often set in and death frequently results.

As far as the home treatment of distemper is concerned, strict isolation from other dogs is, of course, the first consideration. Then, more can be done by sound and careful nursing than by using any of the patent medicines so often advertised. The disease is accompanied by fever in all cases, so that the patient must be kept warm, without, of course, cutting off the supply of good, fresh air. Absolute rest and freedom from excitement are highly necessary also, since the dog needs all his strength to fight the disease that has attacked him. The eyes and nostrils may be cleansed of discharge with boracic lotion. Diet should be light and easily digested, but nourishing and not too drastic a change from his accustomed food. A few days after the onset of symptoms diarrhœa generally occurs. The best course to pursue during this phase is to give a milk diet till it has ceased, and then gradually return to whole diet again.

Distemper is always to be regarded seriously, and veterinary aid should be obtained when possible, as the medicines necessary depend

entirely on the individual dog and the symptoms it shows. Warmth, rest, nourishing light diet, and good nursing are by far the best home treatment any case of distemper can have.

FERRETS AND DISTEMPER.

Dog-owners appear to be generally unaware of the fact that ferrets are attacked by distemper. Not only will the disease spread among ferrets, but also from ferrets to dogs, and *vice versa*. The symptoms in ferrets are high fever, discharge from the nostrils, and the formation of small blisters and pustules round the lips and mouth. Nerve symptoms occasionally occur, as in dogs, and the death-rate is very high. The importance of having these facts in mind, especially to the owners of rabbiting-dogs, is obvious, as also are the precautions indicated by them.

THE RELATION OF METEOROLOGY TO AGRICULTURE.

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LONG-TERM FORECASTS.

THE greatest service that the science of meteorology could render to agriculture would be the accurate forecasting of weather conditions for a fairly long period in advance. The value of such long-term forecasts can be appreciated, allowing as they would an adequate opportunity for the agriculturist to alter or adjust his routine to suit the approaching weather conditions. Were such a service feasible the economic gain to the agricultural community of this Dominion would be immense.

One realizes that, even with the existing short-term forecasts, great benefits would be obtained by agriculturists if more interest were taken and greater credence placed upon them. To-day meteorologists are in the position to render valuable assistance to farmers and collaborate with them with a view to obtaining better crops. The proper interpretation of prepared synoptic weather charts should make it possible to forecast the weather sufficiently early to enable possible injury to crops and stock to be greatly lessened. Although the day-to-day forecasts should apparently prove of value to New Zealand farmers, it has to be admitted that the shortness of the warning-period, coupled with the difficulty of obtaining prompt notice of weather-changes in the average country district, renders such forecasts of little practical value.

By long-time forecasts one does not necessarily infer predictions, say, one month ahead of the event. Such long predictions, of course, would be extremely desirable, but in an insular country such as this, with its paucity of outlying observation stations, they may be regarded as being quite out of the question. Forecasts giving four or five days' notice, widely and rapidly spread throughout the rural communities, and indicating on general broad lines the state of weather likely to be experienced, should be possible. The spread of radio broadcasting will doubtless assist in this respect.

SEASONAL CYCLES.

In rural New Zealand one hears in and out of season questions concerning the likelihood of a wet or dry summer, or a mild or severe winter. The farmer of to-day carries out his work in a more or less routine manner. He sows in the spring with the full expectation and general realization of spring rains, followed by mild weather during the early summer, merging into a general dry period of midsummer, and concluded by the approaching autumn and frosty winter. Unconsciously he postulates a more or less regular season, and hopes that his crop from the time of germination will grow steadily and uninterruptedly to a successful harvest. Thus far he is thoroughly conversant with a more or less definite weather cycle, and all his plans and preparations are made in relation to that cycle. In the majority of years his anticipations are realized and his crops grow favourably, but at other times a bad season or run of seasons is experienced, which greatly offsets the previous beneficial ones.

The anticipation of such seasons would undoubtedly be of great importance, and it should be the aim of the meteorologist to ascertain if a definite cycle of good and bad seasons exists in this country. At first sight it might appear impossible to make such an examination, on account of the comparatively short period of time over which meteorological observations have been made. An interesting attempt, however, was made by Douglas, who by an examination of the annual rings of the giant sequoias of California endeavoured to establish if a definite weather cycle existed in that country. It was naturally assumed that where the annual ring-growth was comparatively great a good season had resulted, and *vice versa*. Douglas examined 450 sequoias, ranging from seven hundred to two thousand years old. A correlation of growth with rainfall was recorded, this being greatest when a period of three years was taken with trees growing in dry situations, and with a period of ten years for trees in a wet situation. Already in New Zealand some preliminary work in this direction has been carried out by Dr. L. Cockayne, in connection with ecological problems, on the beech forests of Westland.

If sufficient statistics of the wheat-yields of Canterbury were available, these, correlated with existing rainfall records and other weather elements, might reveal some such cycle. The system hitherto generally adopted for making weather forecasts appears to have been essentially based on the statistical examination of meteorological data collected at various stations. It is interesting to note that many scientists have endeavoured to establish some connection between the variation in the frequency of sun-spots and the variations in certain terrestrial meteorological phenomena. It would appear essential, if an attempt is to be made in the distant future to correlate crop-yields with weather conditions with a view to investigating a probable cycle of seasons, that typical crop statistics should be taken in close proximity to each station from a few adjacent farms in order to reduce probable error.

CROP PREDICTIONS.

A wide scope lies before meteorologists in predicting the probable yields of different crops from a knowledge of the weather conditions

of the preceding autumn. Sir Napier Shaw in 1905 asserted that the average wheat-yield of England, in five seasons out of six, could be predicted with a certain degree of accuracy. When 39·5 bushels per acre was taken as the mean maximum yield, and a deduction of 1·25 bushels per acre made for each inch of rain which fell during the preceding autumn, a close approximation to the average wheat crop for the year could be obtained. It is interesting to speculate on the possibility of the meteorologist forecasting, say, the probable yield of turnips in Southland from a compilation of data in regard to frost intensity, rainfall, &c., having correlated such data with the optimum conditions for aphides, the organisms of club-root or dry-rot and other parasites of this crop.

There would appear to be no adequate reason why research on such lines should not be carried out, but it is opportune to here state that the services of a specialist in agriculture in addition to meteorology are essential. What would appear, therefore, to be necessary in New Zealand is an agricultural meteorologist. A meteorologist himself could not deal with the agricultural side of the question, neither could he cope with it from a botanical, biological, zoological, or chemical standpoint. Agricultural meteorology is a definite branch of agricultural science, but so far is unrecognized in this country. The agriculturist must indicate the direction the work has to take and point out the object aimed at. The meteorologist must use every means at his disposal to attain this object, and having apparently accomplished this the co-operation of both is essential in order to guarantee the correctness of conclusions arrived at.

AGRICULTURAL ZONES.

The agriculturist is concerned with the propagating of crops. His one aim is to understand the physiological conditions governing their growth, their reaction to environment, and their optimum growing factors. Many climatic factors, such as rainfall, sunshine, frost, &c., have a direct influence on the type of plant which may inhabit a particular locality. Thus we know that certain forms of vegetation will be prevalent in excessively wet districts, and that distinct vegetation will exist in arid districts. In other words, there are undoubtedly in New Zealand definite vegetation zones, which are more or less defined by climatic conditions. Just as vegetation zones exist, so do agricultural zones. Certain agricultural crops grow exceedingly well in the northern part of the Dominion but do not grow well in the south.

There may be wide zones or narrow zones according to the climatic adaptability of the plants under consideration, and it is here suggested that if sufficient meteorological data were obtainable from stations situated in suitable localities, definite agricultural zones would be formed by the correlation of climatic conditions with soil surveys and crop observations. Well-equipped stations under proper supervision should be established in suitable localities to afford such information. The distribution of stations of observation in New Zealand appears to be exceedingly unequal. The exposure of recording-instruments seems to follow no general rule, the instruments being sometimes placed at the top of buildings and sometimes near the ground. There is an undue proportion of stations in the cities and towns, and these are subjected to whatever peculiar conditions exist there.

It would therefore appear that the meteorologist and agriculturist should formulate a chain of stations in desirable localities and in sufficient number to provide the necessary data for the solution of many agricultural problems. Wherever recording-stations are established absolute continuity of records should be aimed at, and frequent inspections of an advisory nature should be made of each station, with a view to remedying any defective instruments and more or less standardizing the methods of observation. To be of value observations must be exact, and if a high standard of efficiency in this respect is to be obtained the meteorological staff must periodically visit the observers.

Where for some reason the site of the station has to be altered, this should be done without any break occurring in the records, and the new site should certainly be in close proximity to the old one if the continuity of records over a long period is to be of value. Government experimental farms would appear to be ideal situations for well-equipped stations, on account of the staff available to carry out the recording-work, the value of such records in experimental farming, and the permanency of the farms themselves. The equipment of such stations and tabulating of data are of great importance, and it is intended herewith to deal with a few of the most important features in this connection.

RAINFALL.

The importance of rainfall upon the growth of plants is sufficiently great to warrant the careful study of this climatic factor. It is to be remembered, however, that since rainfall is so remote from being the immediate environmental condition controlling the water-supply to plants in nature the measurement of this climatic condition must not be regarded as being of great value in regard to plant activity or distribution. The rainfall records at present taken at the majority of stations are by means of an ordinary rain-gauge which collects any rain that may have been precipitated during the day. This method of recording rainfall loses much value from the fact that no indication is given in regard to the intensity of the fall. It would appear, therefore, that in so far as the research agriculturist is concerned greater value of records could be obtained by the installation of self-recording pluviometers. It seems, further, that a better interpretation of the possible effect of a recorded fall could be deduced by a study of the charts recording the rain which had been precipitated during the previous twenty-four hours. This would also eliminate the arbitrary period at present in vogue—namely, 9 a.m. on one day to 9 a.m. on the following day.

EVAPORATION.

Hand-in-hand with rainfall must be considered evaporation. This climatic factor appears to be neglected, but it is inconceivable to carry out a proper study of climatic factors in relation to agriculture without giving due consideration to the rate of evaporation existing in different districts. From a rainfall point of view one district may appear to be "wetter" than another. That is, there would apparently, from rainfall records, be more moisture in the soil for plants—postulating the same water-holding capacity for the soil in both localities. If, however, the relation of rainfall to evaporation is studied for any two districts under discussion it might readily happen that the so-called "wetter" district

was, from the point of view of vegetation, much drier on account of the greater rate of evaporation taking place there.

The rate of evaporation can quite easily and cheaply be recorded from a free surface of water, in a manner similar to that used at the Galloway Irrigation Farm in Central Otago. Unfortunately, there is no direct method of deducing the rate of evaporation of soil-moisture from the results of evaporation from a free surface of water; but, even so, the results of observations of the latter would be of immense help in aiming at conclusions as to the adaptability or otherwise of certain plants and fungi in different localities. Further, the study of the rate of transpiration by plants would be greatly facilitated, especially in those portions of New Zealand requiring irrigation.

It seems surprising that in New Zealand so little has been done in recording evaporation-rates. To obtain data bearing on atmospheric evaporating-power it is only necessary to operate a number of atmometers of the same kind in various climatic districts, being sure that all have similar local exposure. The importance of this condition to plant and animal life, and the relative ease with which it may be measured, warrants earnest consideration being given to the future recording of this climatic feature. Were such data available the ratio of precipitation to evaporation as an index to the external-moisture relation of plants could be ascertained.

WIND.

As a climatic condition that assuredly influences the rate of transpiration from plants and of soil evaporation, and, further, from its often undesirable effect on live-stock and highly specialized crops such as fruit, average wind-velocity, with maximum velocity and duration and also directional origin, should be recorded. Ecologists as well as agriculturists would welcome reliable information in this regard.

SOLAR RADIATION.

The importance of recording hours of sunshine and intensity need not be stressed. It is to be emphasized that the few sunshine-recorders now in this country give but little information as to the intensity of the sunshine itself. They record the duration aspect of that range of intensities which is called direct sunshine, and any data which have been thus collected are consequently of limited value. The intensity of impinging radiation should be recorded, and a systematic attempt to carry out such recording should be put in hand. Beyond a certain intensity sunshine may have a negative effect upon vegetable growth, in that it induces closing of the stomata and partially suspends transpiration and respiration. Probably Livingstone's radio-atmometer may prove to be the most convenient instrument for carrying out records of this nature.

TEMPERATURE.

Data of maximum and minimum temperatures are of great value in deducing the frost-free period of the year, which is of the greatest importance to agriculturists. The frost-free periods of different districts, provided sufficient recording-stations were available, would be most valuable. The average dates of occurrence of the last frost in spring and the first in autumn would furnish a valuable index to

the approximate length of a temperature season of general plant-activity.

The absolute temperature maxima and minima are also valuable as intensity-indices. More information, however, is desirable in regard to (1) the length of the period of high daily normals, and (2) the length of the period of low daily normals. The value of the present available information from the 9 a.m. maximum and minimum temperatures lies in the fact that one can record with a certain degree of accuracy the accumulated temperature in hour-degrees above a chosen datum-line, thus indicating the probable value of such degrees to plant-development. Taking 68° F. as the critical normal daily mean temperature, and 32° F. also as the critical normal daily mean, one would naturally value information from an adequate number of stations in New Zealand of the length of period with normal daily mean temperature of 68° F. or above, and of the length of period with similar means of 32° F. or below, within the year.

Soil-temperatures would also be of value, but the recording of such may be regarded as impracticable on account of the difficulty of establishing a unit of measurement in view of the variation induced by the nature of the soil itself and its situation.

AIR-HUMIDITY.

The usual method of obtaining data in regard to relative air-humidity in New Zealand is by the wet- and dry-bulb thermometers. Relative air-humidity, however, is no direct indication of the absolute amount of moisture in the air, and it is the latter information that is required by agriculturists. Consideration should be given to the fact that as the temperature is lowered the capacity of the air to retain moisture is decreased; and hence it follows, where two stations record the same average percentage of relative humidity but different mean temperatures, that station having the higher mean temperature will have the greater amount of moisture. Air-humidity is of great importance to the farmer. It not only affects the rate of transpiration from plants, but is a deciding factor in the prevalence or otherwise of various parasitic fungi affecting crops. Certain districts in New Zealand are practically free from certain plant-diseases, and it is probably not far from the mark to infer that the relatively low humidity of the air in those districts accounts for such freedom. Mycologists would welcome fuller records of not only the relative humidity of different districts, but also the average humidity of the day.

CONCLUSION.

In conclusion, the following thoughtful statement of Livingstone and Shove ("The Distribution of Vegetation in the United States as related to Climatic Conditions") may be quoted: "Climatological methods and climatological interpretations, as so far developed, are woefully inadequate for the solution of problems dealing with the control of plant-distribution. From the standpoint of ecology and agriculture no great progress is to be expected until much more attention is given to the devising of new methods for obtaining the climatic records and new methods of interpreting these records, and until a new point of view is reached different in many respects from that hitherto held by workers in climatology."

FRUIT VARIETIES FOR EXPORT AND LOCAL MARKETS.

REPORT OF THE 1926 DOMINION CONFERENCE.

J. A. CAMPBELL, Director of the Horticulture Division (Chairman).

THE third Dominion Fruit Varieties Conference was held at the Dominion Farmers' Institute, Wellington, on Friday, 20th August, 1926. Delegates representing fruitgrowers, the Nurserymen's Association, the Institute of Horticulture, the Fruitgrowers' Federation, and the Department of Agriculture were present.

The conference considered and—with the exception of apples and pears for export—adopted the varieties with respect to the different classes of fruit recommended by the provincial conferences previously held to consider the matter. The whole is set out in the subjoined lists.

The conference wishes it to be clearly understood that in view of the fact that at the present time the production of apples and pears is, under existing means of distribution, much in excess of local requirements, and that the position would be further involved should any curtailment of our export trade occur, anything in the nature of extensive planting of these fruits would, in its opinion, be altogether unwise until such time as our export trade shows unmistakable signs of having been established on a sound and payable basis. On the other hand, it is of the opinion that the prospects warrant a reasonable extension of our stone-fruit areas in those districts suited by climate and situation for the purpose. However, if planting in any branch is decided upon, the lists, taken in conjunction with local experience, should enable a suitable selection to be made.

The conference strongly supports the recommendation made by previous conferences for the elimination as rapidly as possible of unsuitable and unpopular export varieties of apples by reworking with one or another of the varieties recommended, thereby reducing the varieties now being exported to a reasonable number. This excessive number of varieties is the weakest spot in our present export practice. Referring thereto the Imperial Economic Committee, in its Third Report, after speaking very highly of New Zealand export practices, on page 92 states: "We would mention that in 1924 South Australia alone shipped no less than fifty-six separate varieties, and New Zealand nearly fifty distinct varieties, to the United Kingdom market . . . and we recommend that producers should take steps to ascertain the most suitable varieties for staple production, to the number of perhaps not more than ten or fifteen, and concentrate on growing these, at the same time taking energetic measures to eliminate unsuitable sorts."

The position last season became worse as far as New Zealand was concerned, for fifty-nine varieties were exported. As already suggested, steps should be taken to remedy this evil as early as possible.

Apples.

NOTES ON VARIETIES RETAINED OR DELETED.

Gravenstein.—This variety has been retained on the list. It is grown to a considerable extent in the Auckland Province and to a lesser degree elsewhere. Although not the best of carriers, its season makes it highly suitable for early shipments, and when properly handled and shipped it should reach the London market in good condition. The strain of Gravenstein, however, recommended by the Committee is that known as Albany Beauty, and nurserymen will be requested to raise this strain under the name of Gravenstein; also, when working over is being done growers are advised to use the Albany Beauty strain.

Golden Pippin has been deleted from the export list, having failed to meet expectations in this connection.

Willie Sharp.—This variety has been substituted for Golden Pippin. In colour the apple is green and golden. The tree is easily grown, and is a consistent bearer, and although not a high-priced apple locally, being early it is suitable for building up early shipments. But the main reason for its inclusion is that it is the best commercial apple of the early season which is at the same time suitable for fertilizing Delicious.

Scarlet and Worcester Pearmain.—Both these varieties have been deleted. They were originally included on account of their colour and early season, but experience has shown that they carry badly, and even when landed on oversea markets in good order frequently fail to bring satisfactory prices.

Cox's Orange, Jonathan, Delicious, Dunn's Favourite, Statesman, and *Sturmer,* having proved themselves to be highly suitable varieties for export in their respective seasons, have been retained.

Cleopatra.—This variety is a great favourite on the English market. Its great fault, however, is hollow or mouldy core. It does better in some districts than in others, and has been retained on the list in the interests of those districts where it does well.

Rome Beauty has proved itself to be a suitable apple for export, and although—like Cleopatra—it is better in some districts than others, it has therefore been retained on the list in the interests of those districts in which it does well.

Brighton.—This is a highly coloured apple. It does well in some parts and should be tried in other districts. It has been added to the list in the interests of Auckland as a substitute for Sturmer, the latter not having proved satisfactory in all parts of the Auckland Province. Grown under certain conditions this variety is said to be subject to Jonathan spot, consequently it would be unwise to plant it largely in any district until after it has been tested.

Tasma.—This is another highly coloured variety, and has proved very satisfactory for export, particularly as grown in the Nelson District. This variety has possibilities. It is said not to succeed in all districts. The Committee therefore recommends that it be generally tested with a view to determining the districts for which it is suited.

Newtown Pippin has proved itself to be a highly suitable variety for export when properly grown, but it is not grown to perfection in all parts of New Zealand. It has been added to the list mainly in the interests of Otago.

Glengyle Red is a highly coloured apple that is worthy of wider attention. It has not yet been fully proved in all districts, but succeeds well in some, notably Canterbury.

Granny Smith.—This is rather a surprising apple, green to yellow in colour, a good cooker, and very fair dessert; but, notwithstanding its appearance, it so far commands a high price on almost all markets on which it has been placed. It is an excellent carrier, but rather on the late side for heavy production for export. However, there should be room for a reasonable production of the variety.

DOMINION LIST OF EXPORT APPLES.

Gravenstein.	Delicious.	Sturmer.
Willie Sharp.	Cleopatra.	Brighton.
Cox's Orange.	Rome Beauty.	Granny Smith.
Dunn's.	Glengyle Red.	Tasma.
Jonathan.	Statesman.	Newtown Pippin.

The representatives of the various districts selected from the Dominion list of varieties recommended for export those varieties best suited for their particular district, as follows:—

Auckland.

Gravenstein.	Dunn's.	Rome Beauty.
Willie Sharp.	Jonathan.	Brighton.
Cox's Orange.	Delicious.	Granny Smith.

Hawke's Bay.

Cox's Orange.	Jonathan.	Delicious.
Dunn's.	Statesman.	Sturmer.

Wairarapa and Wellington.

Cox's Orange.	Jonathan.	Sturmer.
Dunn's.	Delicious.	

Canterbury.

Cox's Orange.	Jonathan.	Glengyle Red.
Dunn's.	Delicious.	Sturmer.

Nelson.

Cox's Orange.	Delicious.	Sturmer.
Dunn's.	Statesman.	Tasma.
Jonathan.		

Otago.

Gravenstein.	Cleopatra.	Sturmer.
Cox's Orange.	Delicious.	Tasma.
Dunn's.	Rome Beauty.	Newtown Pippin.
Jonathan.	Statesman.	

DOMINION LIST OF APPLES FOR LOCAL MARKET.

For the local market the following varieties are recommended in addition to those on the export list:—

Gladstone.	Lord Suffield.	Lord Wolseley.
Beauty of Bath.	Alfriston.	Ballarat.
Red Astrachan.		

VARIETIES OF APPLES FOR FURTHER OBSERVATION.

Varieties of apples placed by the Varieties Conference of 1920 on a list for further consideration were considered. *Glengyle Red* was highly spoken of by Canterbury growers, and by their request is placed on the export list, while in other districts it is to receive further testing. *Granny Smith* received strong support, and was passed for both the export and local market lists. *Brighton* was highly approved by the Auckland delegates and placed on the export list. *Tasma* received similar approval from Nelson growers, and was also added to that list. By unanimous approval *King David, Marian Red, New Gold Pearmain, Premier, Parlin's Beauty, Ranelagh, Rival, Shepherd's Perfection,* and *Giant Jenneton* were struck off the lists.

The following varieties were considered by conference to be worthy of further observation in the different fruitgrowing districts with the view of including them in the list of apples recommended for planting :—

Celo.	Late Market.
Ballarat (Moteo sport).	Salome.
Delicious (Gisborne sport).	Becroft (new strain of Dunn's).
Jonathan (Ettrick sport).	Bonum.
Golden Delicious.	Reinier.
Stayman's Winesap.	McIntosh Red.
McMahon's White.	Seedling No. 16.
Shoreland Queen.	Homing.
Cox's Orange × Delicious Seedling.	

Pears.

DOMINION LIST OF VARIETIES.

Where the planting of pears is decided upon, the selection should be confined mainly to the later keeping varieties, selected to suit the locality, from the following :—

Beurré Bosc.	Winter Cole.	Broompark.
Packham's Triumph.	Josephine de Malines.	L'Inconnue.
Twyford Monarch.	Winter Nélis.	

Where canning facilities are available the following varieties may be planted :—

Williams Bon Chrétien.	Keiffer's Hybrid.

If a rotation of pears is desired, a selection made from this list should prove satisfactory :—

Clapp's Favourite.	Conference.	Winter Nélis.
Williams Bon Chrétien.	Beurré Diel.	P. Barry.
Louise Bonne of Jersey.	Doyenné du Comice.	Broompark.
Beurré Bosc.	Winter Cole.	Twyford Monarch.
Packham's Triumph.	Josephine de Malines.	L'Inconnue.

Stone-fruits.

The local conditions in the different fruitgrowing districts are so varied that district lists only are given of kinds and varieties of stone-fruits recommended for planting. The lists are very long, but as each variety is available only for a short period it is considered necessary to plant a number of suitable varieties to obtain a succession covering the whole season.

Key letters printed with the different varieties denote the following :—

A, Auckland.
H, Hawke's Bay.
N, Nelson.
M, Motueka.
C, Canterbury.
O, Otago.

In addition the following letters are employed to describe the kinds of peaches :—

D, Dessert.
Y, Yellow flesh.
SCl, Semi-clingstone.
C, Canning.
F, Freestone.
W, White flesh.
Cl, Clingstone.

PEACHES.

OH	Le Vainqueur ..	DWSCl.	NCOM	Royal George ..	DWF.
OCMNH	Mayflower ..	DWSCl.	H	Osprey Improved	DWF.
O	Sneed ..	DWSCl.	O	Delicious ..	DYF.
O	Alexander's Early ..	DWSCl.	O	Muir	DCYF.
OCMN	Briggs' Red May	DWSCl.	H	American Pound	DWF.
OH	Sanders ..	DWSCl.	H	Prince of Wales	DWSCl.
H	Husted ..	DWF.	H	Mary's Choice ..	DYF.
H	Eulatus ..	DWF.	OMNH	Kalamazoo ..	DCYF.
OH	High's Early Canada ..	DWSCl.	ON	Lady Palmerston	DCYF.
			OCMHA	Golden Queen ..	DCYCl.
ON	Triumph ..	DCYSCl.	N	Sea Eagle ..	DCYF.
OM	Hale's Early ..	DWSCl.	OA	J. H. Hale ..	DCYF.
OCMNHA	Wiggins ..	DWSCl.	N	Golden Eagle ..	DCYF.
A	Mamie Ross ..	DWSCl.	OHA	Paragon ..	DCYCl.
OHA	Peregrine ..	DWSCl.	ONH	Gold Dust ..	DCYCl.
OHA	Carman ..	DCWF.	HA	Wheatland ..	DCYF.
ONA	Kia Ora ..	DCYF.	H	Late Crawford ..	DYF.
A	Stark ..	DWF.	OCHA	Salway ..	CYF.
A	Ar	DCYCl.	HA	Lippiatt's Late Red ..	DWCl.
MNH	Elberta ..	CYF	M	Pullar's Cling ..	CYCl.

NECTARINES.

OA	Ansenne.	OCMNHA	Goldmine.
CMH	Early Rivers.	H	Victoria.
N	New Boy.		

PLUMS (ENGLISH).

C	American Early.	ONH	Pond's Seedling.
OCMNH	Evans' Early.	OCH	Coe's Golden Drop.
OMNH	Early Rivers.	OCMNH	Diamond.
C	Rivers' Early Prolific.	OCH	Magnum Bonum (yellow).
OC	Early Orleans.	ONH	Jefferson.
OCNH	Angelina Burdett.	ONH	Monarch.
OCH	Greengage.	O	President.
M	Reine Claude de Bavay.	OCNH	Grand Duke.
OCH	Kirk's.		

PLUMS (JAPANESE).

N	Hermisillo.	HA	Sultan.
HA	Sharp's Early.	A	Wickson.
OCNHA	Wright's Early.	HA	Purple King.
OCMNHA	Burbank.	MNHA	October Purple.
A	Doris.	N	Doris.
ONA	Satsuma.		

PRUNES.

A	Fellenberg.	A	Petite d'Agen.
A	Golden Prune.	OHA	Tragedy.
ONH	Giant.	O	Silver Prune.

APRICOTS.

OCNA	Newcastle.	OA	Boulton.
OCA	Oullin's Early.	OA	Hemskirk.
OCNA	Roxburgh Large Red.	OA	Royal Late.
OCNA	Moorpark.	CA	Mansfield's Seedling.

CHERRIES.

OCMNH	Early Purple Guigne.	C	Black Republican.
OCMN	Werder's Early Black.	C	Chapman.
OH	Early Lyons.	C	Doncaster Prolific.
OCMNH	Early Rivers.	H	Bigarreau Jaboulay.
O	Knight's Early Black.	OCMH	Bedford Prolific.
CN	Black Heart.	O	Centennial.
OCMNH	Black Tartarian.	OMH	Florence.
OCMNH	Bigarreau Napoleon.	OH	Black Eagle.
O	May Duke.	OCMNH	St. Margaret.
H	White Heart.	O	Black St. Margaret (Australian).
C	White Elton.		
C	Bigarreau.	O	Bing.

STONE-FRUITS FOR FURTHER OBSERVATION IN THE VARIOUS DISTRICTS.

The following list was drawn up for this purpose :—

Auckland.—Plums (Japanese) : Dreadnought, Billington's Seedling.

Hawke's Bay.—Canning peaches : Tuscan, Phillips, Sims, Pullar's.

Otago.—Peaches : Royal Charlotte, Husted's Early, Osprey Improved.

Nectarines : Lily Baltet, Grand Admiral, Victoria.

Plums (English) : Reine Claude de Bavay, Washington, Victoria.

Plums (Japanese) : Doris, Santa Rosa, Bellena, Hermosilla, Maynard.

Prunes : Splendour, Goliath, Hungarian.

Apricots : Large Early, Late Warwick, Harris, Sunrise, Riverside, Tilton.

Cherries : Frubeste der Mark, Chapman, Belle Ellen, Claremount, Gean d'Annonay, Noble.

Citrus-fruits.

The Committee appointed by conference to deal with citrus-fruits reported as shown in the following lists :—

	Varieties recommended for Planting.	Varieties recommended for Further Trial.
Lemons	Lisbon, Eureka.	Genoa, Meyer.
Limes	Tahiti.	
Oranges (sweet) ..	Navelencia, Valencia Late.	Best's Seedless, Gold Nugget, Navel.
Oranges (preserving) ..	Poorman.	..
Pomelos	March Seedless.	Foster, Sampson Tangelo.
Mandarins	Scarlet, Thorny.	Dancy's, Ellendale Beauty.

AGRICULTURAL SEEDS.

NOTES AND FIGURES ON VARIOUS ASPECTS.

NELSON R. FOY, Seed Analyst, Biological Laboratory, Wellington.

THE information pertaining to farm seeds contained in the following notes has been prepared in response to various inquiries from readers of the *Journal*, and should be useful for reference purposes.

NUMBER OF SEEDS PER POUND WEIGHT.

This figure naturally varies as between different samples of the same kind of seed. Particulars of the various species presented in Table 1 are averages of a considerable number of estimations made at this Laboratory.

Table 1.—Showing Average Germination, Number of Seeds per Pound, and Number of Viable Seeds in 1 lb. of Average Seed.

Seed.	Average Germination.	Number of Seeds per Pound.	Number of Viable Seeds per Pound.
	Per Cent.		
Perennial rye-grass	85	243,500	207,000
Italian rye-grass	85	229,000	195,000
Western Wolths rye-grass	85	225,000	192,000
Timothy	90	1,160,000	1,000,000
Cocksfoot	65	510,000	332,000
Meadow-fescue	75	252,500	189,000
Chewings fescue	90	487,500	439,000
Crested dogstail	90	820,500	738,000
Meadow-foxtail	30	540,000	162,000
Red-top	90	5,250,000	4,725,000
Brown-top	80	5,500,000	4,400,000
Poa pratensis	55	2,265,000	1,249,000
Prairie-grass	60	38,000	22,800
Danthonia pilosa	50	560,000	280,000
Danthonia semiannularis	50	880,000	440,000
Paspalum	40	454,000	181,600
Red clover	90	240,000	216,000
White clover	90	670,000	603,000
Alsike	90	650,000	585,000
Suckling-clover	90	1,000,000	900,000
English trefoil	90	305,000	274,500
Lotus hispidus	80	930,000	744,000
Lotus major	80	925,000	736,000
Lucerne	90	240,000	216,000

LONGEVITY OF SEEDS.

The period for which seeds retain vitality varies considerably, both as regards the different species and within an individual species. Retention of viability is dependent upon so many factors—such as degree of maturity when harvested, humidity at harvest, and humidity and temperature during storage—that it is difficult to lay down any definite period. Table 2 has been compiled from a series of tests carried out at this Laboratory on a number of average commercial samples, and

shows the average growth at intervals from August, 1924, to September, 1926. All the seed was harvested in 1924, and is, therefore, nearly three years old.

The figures given in Table 3 are taken from tables published by K. Dorph Petersen, Director of the Danish Seed-testing Station, and

Table 2.—Showing Rate of Decline in Germination of Main Grass and Clover Seeds.

Seed.	Aug., 1924.	Oct., 1924.	Feb., 1925.	June, 1925.	Sept., 1925.	Feb., 1926.	June, 1926.	Sept., 1926.
White clover ..	98	99	96	97	98	98	98	98
Cow-grass	98	95	99	98	99	99	90	92
Lucerne	96	96	97	96	95	94	94	76
Lotus major	95	92	90	91	90	90	90	96
Perennial rye-grass (1)	92	90	90	86	81	76	77	68
Perennial rye-grass (2)	98	98	96	92	89	86	83	75
Perennial rye-grass (3)	99	98	98	96	94	95	98	96
Perennial rye-grass (4)	92	90	89	87	86	86	81	84
Italian rye-grass ..	94	95	91	92	93	90	84	88
Brown-top	78	75	74	72	74	75	79	72
Crested dogstail (1) ..	97	96	97	89	77	70	70	61
Crested dogstail (2) ..	92	92	90	76	38	19	19	0
Chewings fescue ..	92	90	74	62	30	1	0	0
Danthonia pilosa ..	40	37	17	12	11	5	4	11
Cocksfoot (1) ..	65	57	51	51	49	50	48	37
Cocksfoot (2) ..	70	67	70	69	64	60	61	44
Paspalum	62	58	61	56	49	48	51	52

Table 3.—Showing Decline in Germination over a Period of Years: Tests made at Danish Seed-control Station, Copenhagen, under Continental System.

The figures preceded by the plus sign (+) in the clovers, &c., refer to the percentage of hard seeds.

Seed.	One Year.	Two Years.	Three Years.	Four Years.	Five Years.	Ten Years.	Fifteen Years.	Twenty Years.
Red clover	97+ 3	99+ 1	97+ 3	86+ 5	48+ 4	0+ 3	..	..
White clover.. ..	83+15	77+33	80+10	79+12	61+16	8+10	7+6	0+10
Alsike	83+16	81+18	83+15	77+19	53+17	1+14	7+6	1+ 7
Lucerne	91+ 8	88+ 7	93+ 3	84+ 3	79+ 3	34+ 4	4+0	..
Crimson clover ..	98+ 0	95+ 1	90+ 0	41+ 0	1+ 0	..	..	..
Lotus corniculatus ..	75+18	81+14	73+13	67+ 9	40+11	1+12	0+8	0+10
Timothy	98	95	91	79	53	..	..	..
Perennial rye-grass ..	92	89	89	87	67	..	..	..
Italian rye-grass ..	83	79	79	65	57	2	..	..
Meadow-fescue ..	98	94	96	81	42	..	..	..
Sheep's fescue ..	89	84	76	54	14	..	..	..
Cocksfoot	90	85	88	88	77	1	..	..
Meadow-foxtail ..	89	84	66	56	30	..	..	..
Agrostis sp.	91	96	93	92	92	32	..	..
Poa pratensis ..	78	94	87	85	72	1	..	..
Crested dogstail ..	63	53	33	13	5	..	..	..
Oats	84	71	81	75	59	32	..	..
Barley	100	100	97	90	42	5	..	..
Wheat	92	95	87	88	74	..	..	..
Mangold	84	90	88	86	92	53	1	..
Turnip	98	97	98	95	98	66	..	..
Carrot	77	69	65	53	39	..	..	..
Peas	87	..	90	94	90	47	..	..

serve to show the decline in germination over a period of years. It should be remembered that these percentages refer to actual samples, and are not to be taken as standard for each species; also that the percentages refer to the total germination, and that while this may be reasonably high the vitality of the seed as shown by speed of growth will have decreased to a much greater extent. Summarizing the two tables (Nos. 1 and 2), it can be taken that with one or two exceptions seed for sowing purposes should not be kept longer than two years after purchase, at which time the seed will probably be about three years old.

GERMINATION.

The average germination of the different species varies considerably —what is high for one may be low for another. The average germination percentages for this country are shown in Table 1. Approximate grading according to germination is presented in Table 4.

Table 4.—Grading according to Germination.

Grade 1: First-class commercial seed. Grade 2: Average quality. Grade 3: Below average quality. Grade 4: Seed of little value.

Seed.	Grade 1.	Grade 2.	Grade 3.	Grade 4.
Cocksfoot—Danish	85–100	65–84	40–64	Below 40
Cocksfoot—Akaroa	75–100	60–74	40–59	40
Rye-grass	90–100	80–89	50–79	50
Crested dogstail	90–100	80–89	50–79	50
Chewings fescue	90–100	80–89	50–79	50
Meadow-fescue	85–100	75–84	50–74	50
Brown-top	85–100	70–84	50–69	50
Danthonia	60–100	35–59	25–34	25
Timothy	90–100	80–89	60–79	60
Poa pratensis	75–100	60–74	45–59	45
Paspalum	60–100	35–59	25–34	25
Meadow-foxtail	50–100	30–49	20–29	20
White clover and alsike	95–100	85–94	70–84	70
Cow-grass				
Lucerne				
Lotus sp.	85–100	70–84	50–69	50
Swede and turnip	90–100	80–89	70–79	70
Mangold	80–100	65–79	50–64	50

MOISTURE CONTENT.

The ability of seed to retain vitality is intimately associated with the water content. The drier the seed the longer will vitality be held, and *vice versa*. Consequently seeds held over from one season to another should be stored under the driest conditions obtainable.

The average moisture content of grass-seeds ranges from 10 to 15 per cent.; of clovers, lucerne, &c., 8 to 12 per cent.; of turnips, rape, and swede seed, 7 to 10 per cent.; and of mangold, 12 to 16 per cent.

BUSHEL-WEIGHT.

True bushel-weight is the weight of seed in pounds which will fill a measure having a capacity of 1·28 cubic feet. This weight is dependent upon two factors —the density of the seed or grain itself, and the degree

of closeness with which, by virtue of its size, the seed is packed in the container. Thus it follows from the first-mentioned factor that full berried seed will show a higher bushel-weight than that with a small kernel and a large proportion of chaff, and from the second factor that small shotty seed will show a higher bushel-weight than larger-grained seed. The difference in bushel-weight between Akaroa and Danish cocksfoot is due to the difference in seed density, there being a greater proportion of chaff in Akaroa than in Danish. Again, the influence of the second factor gives small-seeded Hawke's Bay rye-grass a higher weight than Canterbury or Southern seed, there being less interspace in the Hawke's Bay seed.

The true or natural bushel-weight is used mainly in computing the value of undressed seed, which later, with one or two exceptions, is dressed up to its full weight—*i.e.*, the bushel-weight shown when chaff or light seed can no longer be economically removed. To ensure as close packing as possible brushes and polishers are used to remove bristles, &c., which would increase the amount of interspacing and lower the weight.

In New Zealand certain seeds are sold by the bushel—known as the standard bushel. This is an arbitrarily fixed weight, and has no relation to true bushel-weight. Thus the standard weight for rye-grass is 20 lb., and the purchaser receives 20 lb. for the stated price per bushel whether the true bushel-weight be 26 lb. or 32 lb.

Table 5.—Showing True and Standard Bushel-weights for Seeds and Grains.

Seed.	True Bushel-weight.	Standard Bushel-weight.
	lb.	lb.
Perennial rye-grass	18–32	20
Italian rye-grass	18–28	20
Cocksfoot	16–20	16–17 Akaroa.* 17–18 Danish.*
Crested dogstail	26–36	..
Timothy	45–50	..
Meadow-foxtail	6–12	..
Meadow-fescue	20–28	..
Chewings fescue	20–30	..
Poa pratensis	20–28	..
Red-top	36–40	..
Danthonia pilosa	4– 8	..
Danthonia semiannularis	2– 6	..
Paspalum	14–20	..
Prairie-grass	16–18	..
Cow-grass	64–66	..
White clover	65–68	..
Alsike	62–66	..
Lotus major	65–68	..
Wheat	65–68	60
Barley	65–68	50
Oats	65–68	40
Peas	65–68	60
Tares	65–68	60
Maize	65–68	56

* Fixed standard of true weight.

The term "standard weight" is used also with cocksfoot, but this refers to a fixed standard of true weight. Thus Akaroa cocksfoot is always sold at 16–17 lb., whereas other seeds have a wide range of weight. This 16–17 lb. standard is the weight to which all Akaroa seed is dressed, and when this weight is reached no more chaff, &c., is removed. Akaroa cocksfoot could be dressed up to a full natural weight of 20–22 lb., but the heavy dressing losses would necessitate an increase in the retail prices.

PURITY.

Most seeds on the market in New Zealand are machine-cleaned to a very high state of purity, and it is only in the low grade so-called pasture and clover mixtures (mainly dressings) that an excess of weed-seed is found. There are, however, certain machine-cleaned seeds which are liable to contain seeds of noxious weeds, and while some of these may not be a matter for great concern on certain poorer classes of land, their presence is dangerous in dairying and other than sheep-grazing country.

The weed-seeds referred to are Californian thistle in crested dogs-tail; dodder in clovers, Lotus major, and brown-top; ox-eye daisy in Danish cocksfoot and brown-top; and ragwort in Lotus major.

The following shows the number of seeds per pound represented by the presence of 1 per cent. of the more common seed impurities:—

Rib-grass	2,500	Ox-eye daisy ..	11,000
Catsear	5,300	Docks	3,000
Californian thistle ..	4,400	Sorrel	10,000
Dodder	13,000	Chickweed ..	12,000

MACROCARPA TIMBER IN FRUIT-CASES AND OCCURRENCE OF APPLE-SCALD.

INVESTIGATING recently the prevalence of a severe scald condition in a line of Sturmer apples in a cool store at Hastings, the writer's attention was drawn to the timber used for the construction of the cases in which scalded fruits occurred. In every instance one or two boards of macrocarpa cyprus were used. Further investigation gave conclusive evidence that these boards were responsible for the damage. A questionable case was selected from a number taken out of store for repacking, and was opened on a side made up of two pieces of timber, one a 7 in. macrocarpa board, the other a 4 in. insignis-pine board. Every apple in the three rows immediately beneath the macrocarpa was scalded, while those beneath the insignis pine were perfectly sound. In addition to the scald condition the fruit in close proximity to the macrocarpa boards was severely tainted, not only having a strong odour resembling that of creosote, but tasting equally strong. The miller of the timber, however, stated that it had not been treated with any such preservative. As there is no doubt as to the detrimental effect in this instance, it is clear that macrocarpa timber should not be used for fruit-cases.

—*N. J. Adamson, Orchard Instructor, Hastings.*

Orchard Registration and Tax.—For the official year of 1925–26 a total of 6,637 commercial orchards were registered and tax-demand notices issued to the occupiers by the Horticulture Division; £1,502 was collected in orchard-tax and handed over to the New Zealand Fruitgrowers' Federation less cost of collection. The tax is computed at the rate of 1s. per acre, with a minimum charge of 2s. 6d.

EXPERIMENTS ON MANURING OF TURNIPS IN CANTERBURY, SEASONS 1924–25 AND 1925–26.

A. W. Hudson, B.Agr., B.Sc., Instructor in Agriculture, Christchurch.

In the 1924–25 season one experiment on the manuring of turnips was conducted at the farm of R. S. Gunn, Racecourse Hill. In the 1925–26 season three on turnips and one on swedes were laid down at the same farm, but owing to the ravages of the grass-grub beetle in two cases, and the dryness of the early summer in the case of the swedes, only one of the experiments reached maturity.

A. Experiment in 1924–25 Season.

Date of sowing: 26th January, 1925. Varieties: Two-thirds Imperial Green Globe and one-third Fosterton Hybrid, sown at the rate of 9 oz. per acre in rows 14 in. apart. The paddock had been in grass previously. The manures used were:—

	Per Acre.
(1.) Superphosphate (42–44 per cent.)	1 cwt.
(2.) Ephos basic phosphate	1 cwt.
(3.) Nauru rock phosphate	1 cwt.
(4.) Super, ½ cwt., plus Ephos, ½ cwt.	1 cwt.
(5.) Super, ½ cwt., plus Nauru, ½ cwt.	1 cwt.
(6.) Super, 1 cwt., plus dried blood, ½ cwt.	1½ cwt.

Four replications of each treatment other than super were sown Super was used as the standard of comparison, and every third plot was sown with this manure. This arrangement allowed each treatment other than the standard (super) to be compared with a super plot immediately alongside it. The drill used was a 15-coulter machine, so that with 14 in. rows eight drills were sown to each width of the drill, which constituted a plot. Weighings made were taken from the three rows falling nearest the middle of the plot. Nine weighings, each 5½ yards long, were made in each plot, so that with four replications thirty-six weighings on the super plots were compared with thirty-six weighings on each of the other treatments. Total weights—roots and tops—were recorded.

The turnips on the super and super-plus-blood plots were the largest, but were evidently fewer in number. Hence it seemed certain that these treatments had an adverse effect on germination. This was tested in the following season, and is described below. The yields of the plots, which were weighed on 26th May, 1925, are shown in Table 1.

Comments on Table 1.

(1.) The yield of the super plots has proved superior to those of the Ephos and Nauru to the extent of about 2 tons per acre.

(2.) The mixture of super and Ephos shows an increase of about 18 cwt. per acre over super.

(3.) The super-plus-Nauru and super-plus-blood yields are not significantly different from those of the super.

Table 1.—Yield of Turnips, Season 1924–25 Experiment.

Area of individual weighed plot = $\frac{1}{704}$ acre.

Treatment other than Super.	Number of Paired Plots.	Yield per Acre.			Difference significant (S) or non-significant (N-S).*
		Treatment named in Column 1.	Adjacent Super Plots.	Difference (+) in Favour of Super or (−) of other Treatment.	
		Tons.	Tons.	Tons.	
Ephos	36	15·5	17·5	+2·0	S.
Nauru	36	16·0	18·2	+2·2	S.
Super and Ephos	36	18·9	18·0	−0·9	S.
Super and Nauru	36	18·4	18·2	−0·2	N-S.
Super and blood	36	18·3	17·8	−0·5	N-S.

NOTE.—An unmanured plot sown for the purpose of observation yielded 13 tons per acre.

* A difference is regarded as "significant" when the chances are greater than 30 to 1 in its favour. When the chances are less than 30 to 1 the difference is "non-significant."

B. Experiment in 1925–26 Season.

Date sown: 22nd December, 1925. Variety: Hardy Green Globe, sown at the rate of 9 oz. per acre in 14 in. rows. The manures used were the same as those of the previous season's experiment, with the exception of the dried blood, which was increased to 1 cwt. per acre. As before, the manure was applied to the seed rows with the seed. The method of sowing was as described in this *Journal* for July last, page 11. Twelve replications of each treatment were sown.

Effect of Manures on Germination.

To determine the effect of the various manures on germination, counts were taken (as described in the *Journal* for July, page 11) on 19th January, 1926, about a month after sowing. The means of forty-seven counts on each treatment are as follows:—

(*a.*) Super	.. ..	14·6 plants per 10 ft. x 1 row.
(*b.*) Ephos	.. ..	21·7 ,,
(*c.*) Super plus Ephos	..	18·9 ,,
(*d.*) Nauru	.. ..	19·9 ,,
(*e.*) Super plus Nauru	..	17·4 ,,
(*f.*) Super plus blood	..	10·5 ,,

The chances are greater than 24,000 to 1 that treatments (*b*), (*c*), (*d*), and (*e*) have a larger number of plants per unit distance than (*a*). The chances are equally great that (*f*) has a smaller number of plants per unit distance than (*a*).

The chances are about 1,350 to 1 that the mean of the counts of the Ephos plots is greater than the mean of the counts on the super-plus-Ephos plots.

Nauru has a superiority in number of plants over super plus Nauru, with chances of about 3,000 to 1 in favour of significance.

It is evident that the soluble phosphate—super—has had an adverse effect on germination, as compared with the insoluble phosphates—Ephos and Nauru.

Blood when added to super has still further increased the damage to germination. The smaller number of plants on the plots with the mixed phosphates, as compared with those having insoluble phosphates, indicates that even in the mixtures super has adversely affected germination. As will be seen in Table 2, there is no relationship between number of plants and yield, and it seems probable that if the bad effect on germination due to super can be overcome still better yields may result.

Observations during Growth.

At the time of taking germination counts, on 19th January, the super-plus-blood, super-plus-Ephos, and Ephos plots were slightly superior from the point of view of appearance. The Nauru plots were decidedly inferior, having small and yellow plants.

About five weeks later, on 23rd February, the super-plus-blood, super, super-plus-Ephos, and super-plus-Nauru plots were the best, displaying a deep-green colour as compared with a medium growth and pale-green colour of the Ephos plots. Nauru was decidedly poor. An unmanured plot sown for observation had practically nothing on it (Fig. 1).

The plots were weighed on 10th and 11th June, twenty-four weeks after sowing. All tops had died off. Fig. 2 shows the appearance of the plots at this date. The yields are given in Table 2.

Table 2.—Yield of Turnips, Season 1925–26 Experiment.

Area of individual weighed plots = $\frac{7}{128}$ acre.

Comparison A *versus* B.	Number of Paired Plots.	Yield per Acre.	Difference in Favour of A.	Difference significant (S) or non-significant (N-S).*	Number of Plants per 10 ft. (mean of 47 counts).
		Tons.	Tons.		
A. Super	32	15·5	0·8	N-S.	14·6
B. Ephos	..	14·7	..	..	21·7
A. Super plus Ephos	..	16·5	1·0	S.	18·9
B. Super	32	15·5	..	..	14·6
A. Super	8	16·5	7·2	S.	14·6
B. Nauru	..	9·3	..	..	19·9
A. Super	..	15·5	1·0	S.	14·6
B. Super plus Nauru	32	14·5	..	..	17·4
A. Super plus blood	..	18·8	3·3	S.	10·5
B. Super	32	15·5	..	..	14·6
A. Super plus Ephos	32	16·5	1·8	S.	18·9
B. Ephos	..	14·7	..	..	21·7

* See footnote to Table 1.

FIG. 1. AN UNMANURED STRIP (MIDDLE) IN ONE OF THE EXPERIMENTS.

This was sown for purposes of observation. Only a few small turnips are present.

FIG. 2. APPEARANCE OF PORTION OF PLOTS AT TIME OF WEIGHING.

Four rows with pole in middle, super; four rows on right, Ephos; four rows on left, Nauru. The greater number of turnips on the Ephos plots is evident.

Photos by A. W. Hudson

Comments on Table 2.

(1.) Although the difference in yield between the super and Ephos plots has odds of only 16 to 1 in its favour, it is probable that a larger number of weighings and consequent reduction in the probable error would have established the difference as a real one.

(2.) The mixture of super plus Ephos shows an increase over super of 1 ton per acre.

(3.) The very poor yield on the Nauru plots is in striking contrast to their behaviour in the previous season, when their yield equalled that of the Ephos plots.

(4.) The mixture of super and Nauru has not done as well as the straight super.

(5.) In spite of the great diminution in germination, the addition of 1 cwt. of blood to the super has increased the yield by about $3\frac{1}{3}$ tons per acre. The difficulty of arriving at the value of turnips makes it hard to measure the profit resulting, but if turnips were worth only 4s. per ton the increase would be sufficient to pay for the application of the blood. They must, however, be of greater value than 4s. per ton. In the previous season $\frac{1}{2}$ cwt. of blood did not increase the yield by a significant amount.

(6.) The mixture of super plus Ephos gives a decidedly better yield —to the extent of 1·8 tons per acre—than Ephos alone.

General.

The germination should be studied in conjunction with the yield. Undoubtedly the soluble phosphate is the most valuable form, and if its effect on germination can be overcome a considerable increase in yield should result. Whether the mixing with a slow-acting phosphate is justified must depend on whether greater benefit can or cannot be derived by eliminating this effect on germination. Further results must be obtained before the use of an expensive constituent such as blood can be recommended. Here also the germination effect must be considered.

It might be argued that thicker seeding would compensate for damage to seed, but in the writer's opinion this would not be satisfactory. Thinning due to manure does not take place uniformly, and no matter what the seeding is there would still be bare spaces alternating with closely growing ones.

Thanks are due to Mr. Gunn for his keen co-operation in the work. Mr. F. E. Ward was associated with the writer in the carrying-out of the experiment in the 1924–25 season, and his valued guidance and assistance are here acknowledged.

Honey Export.—The quantity of honey exported from New Zealand during the year ended 31st March, 1926, was 15,770 cwt., valued at £51,733. The following figures, showing quantities and values of honey exported from the Dominion during the preceding five years, are quoted for comparison: 1922, 8,542 cwt, £31,943; 1923, 10,605 cwt., £43,032; 1924, 9,157 cwt., £26,910; 1925, 10,836 cwt., £30,549.

RURAL SANITATION.

ADVICE FOR FARMERS.

New Zealand Department of Health.

THE necessity for as high a standard of sanitation in rural districts as in towns is essential if the health of the community is to be maintained. The institution and maintenance of a high standard of sanitation do not of necessity require a large expenditure. In most cases a little forethought in the planning and lay-out, followed by some attention later, will prevent objectionable conditions which militate against the well-being of the members of a particular dwelling and react more or less on the whole community.

The town-dweller has from a public-health standpoint some advantages over his country cousin, in that he is surrounded by restrictions which require that his house, when built, shall conform to certain standards and be properly drained, whilst the local authority takes the responsibility for providing him with a pure, wholesome, and plentiful supply of water, and the removal and disposal of all waste products from the dwelling, and generally endeavours to provide conditions which make for health. The responsibility for keeping the premises sanitary, however, rests with the owner or occupier, and in spite of facilities provided it is only too often evident that some people in our towns do not appreciate the value of sanitary conditions nor take the slightest interest in the health of the inmates of their homes.

On the other hand, conditions in the country are different. The country dweller frequently selects his site, plans the lay-out, builds his house and farm buildings, provides his water-supply, and makes provision for the disposal of waste products according to his own ideas and without reference to those who could assist him to start off along lines which would make for healthy living-conditions for himself and family. Fortunately, the question of rural sanitation has during recent years been receiving more attention than formerly, and by-laws are being brought into operation in different parts of the country ensuring that various health matters in connection with dwellings shall conform to certain standards. Much, however, still remains to be done, and the greatest progress will be made when the people as a whole begin to take an active interest in sanitary science.

In these notes it is quite impossible other than to touch on the fringe of the various subjects which come up for consideration, and whilst the major portion dealt with will be rural, other aspects will be applicable to urban and rural districts alike.

THE HOMESTEAD AND FARM BUILDINGS.

The homestead-site should be elevated, sunny, sheltered from prevailing winds, and preferably have a northerly aspect. Consideration should also be given to the nature of the subsoil, which should be such as will ensure a dry and therefore healthy site. One of the principal influences of the soil upon general health is through soil-moisture. Dampness in or near the surface of the soil may affect the health of those dwelling near by. Such a soil is cold, and the atmosphere immediately above it is liable to be damp, and this appears

to conduce to rheumatism, neuralgia, and diseases of the respiratory tract.

The dwelling should be so constructed as to prevent ground air or moisture or atmospheric moisture entering the building, and to this end the floor-timbers should be clear of the ground, efficient under-floor ventilation provided, damp-proofing carried out as necessary, spouting and downpipes fixed, and the whole structure built of good materials and in a workmanlike manner. Lighting and ventilation must also receive every attention.

Every consideration should also be given to the position and type of the farm buildings, thus helping to reduce the labour incidental on attending to stock, and simplifying the prevention of undesirable conditions.

WATER-SUPPLY.

Care must be taken that the water-supply is pure, wholesome, and plenteous. If the water is procured from the subsoil the well should be sunk in such a position and so constructed and finished on top that there is no danger of contamination. Where storage is necessary, care should be taken that the storage tanks are built of material which will not injuriously affect the water, and are so constructed as to be protected from dust and vermin. They should, however, be in easily accessible positions and provided with facilities for periodic cleansing.

DRAINAGE.

The method of drainage-disposal must be considered in relation to the local conditions, and always with a view to the avoidance of conditions which are objectionable or likely to be dangerous to health. A variety of means are available under different circumstances, and these may be briefly summarized as follows: (1) Discharge direct into the sea or large river; (2) land treatment; (3) liquefying-tanks and filter-beds.

The practice of discharging drainage on to street-channels and road-ditches has been all too common in the past, and has resulted in most objectionable conditions arising. When, however, the sea is available, or a large river which is not used as a water-supply, there can be little objection, excepting in certain cases, to the discharge of drainage direct into either. Where, however, isolated houses are so situated that a natural drainage outfall is not available, a very real problem has to be faced.

Surface irrigation or the discharge of waste water over the surface of the land is not a practice to be recommended for the average private dwelling; nevertheless in the case of houses with a limited water-supply and only a single fitting inside, it is possible for the waste water to be disposed of on freshly cultivated land, or around vegetables, without engendering objectionable conditions or encouraging flies or other vermin.

Subsurface irrigation carried out by laying lines of open jointed pipes some 12 in. below the surface may be employed. In this case the drainage is disposed of by soakage into the surrounding soil, and also taken up by the roots of surface vegetation. One of the difficulties in this method of disposal is to ensure that the drainage is equally distributed over the whole line of pipes, and for this purpose it is necessary, excepting possibly on sections with a steep gradient, to provide a collecting chamber with an automatic flush. Where the subsoil

is porous a soak-pit may be used, the main care which will be necessary in this case being to ensure that the surface of the pit does not clog. The provision of a small rectangular grease-trap, so constructed as to permit daily removal of grease, and so placed as to take the drainage from such interior fittings as the kitchen-sink, will usually obviate this. In a stiff clay artificial soak trenches and pits may be constructed, success depending in this case on the area of trenches and pits prepared, in comparison with the volume of drainage and the means adopted to utilize the whole soakage area.

In every instance where drainage-disposal is by subsurface irrigation or soak-pit, care must be taken to ensure that the underground water-supplies are not endangered. It should be remembered that the purifying action of the soil is largely dependent upon bacteria, and that this action takes place almost solely in the upper layers. If carcases are buried deeply, or if sewage is allowed to enter the soil at several feet below the surface, the process of purification is long delayed or checked. A leaking cesspool or broken drain which discharges its contents into the soil at a depth of 5 ft. or more may seriously pollute the ground-water, whereas the same material placed upon or just beneath the surface may be entirely mineralized, or all infection destroyed before it reaches a depth of 5 ft. Trees buried deeply where bacterial action is practically absent remain for many hundreds of years virtually unchanged.

SEPTIC TANKS AND FILTER-BEDS.

Where a good water-supply is available it is becoming increasingly common in country houses to install water-closets and construct septic tanks. Probably no other sanitary fitting has been so much discussed and so little understood by the average individual as the septic tank. The impression has got into certain minds that the septic tank is the be-all and end-all of sewage-purification, and if they but install a septic tank any liquid which may pass through the tank can be discharged anywhere without the danger of creating a nuisance. In spite of misconceptions, however, a properly constructed septic tank is a useful adjunct in certain systems of sewage-disposal, mainly because of its liquefying action on solid matters in the sewage. The effluent which passes from the tank, although it is still sewage, is nevertheless now in such a condition as to permit of further treatment either on land or filter-beds.

Filter-beds for sewage installations to private houses, except where they can be installed well away from dwellings and be under constant intelligent care, are not, however, to be recommended, because of the possibilities they provide for the creation of unpleasant odours.

DISPOSAL OF REFUSE.

The sanitary disposal of refuse, including vegetable refuse and manure, requires every care and attention. Vegetable refuse should, as soon as possible, be burned or trenched into the ground. The disposal of manure, particularly horse-manure, should receive the intelligent attention of every one interested in the well-being of the people. (This subject was dealt with in a previous article on "The Fly.") Horse-manure provides an ideal breeding-ground for flies, and whilst it may not be possible to eliminate the fly pest completely it is possible to considerably reduce their numbers and their rate of increase.

TESTING OF PUREBRED DAIRY COWS.

NOVEMBER CERTIFICATE-OF-RECORD LIST.

Dairy Division.

THE appended list gives details of performance of cows which received certificates during November, 1926. It will be noted the list includes a number of excellent records among the several breeds.

LIST OF RECORDS.

* Cow milked three times daily during whole lactation period. † Milked three times daily during part of period.

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS.						
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Alfalfa Supremacy ..	A. A. Wagstaff, Waihou ..	1 281	240·5	365	10,292·3	650·37
Oaklands Velyusa ..	T. M. Remington, Westmere	1 363	240·5	365	8,886·9	604·31
Oaklands Viscountess	T. H. Western, Bell Block..	1 342	240·5	365	8,281·7	560·95
Miro Meadows Ruth..	H. E. Walters, Waitoa ..	1 301	240·5	365	9,722·4	554·29
Brooklyn Lady Dolly	H. J. Lancaster, Glen Oroua	1 354	240·5	365	10,384·1	542·06
Waipiko Fairy Queen	S. H. Wearing, Richmond ..	1 322	240·5	365	9,445·4	541·66
Ku Ku Duchess ..	R. L. Horn, sen., Ohau ..	2 20	242·5	365	10,559·5	508·61
Jersey Brae Patch ..	T. Church, Te Rapa ..	2 14	241·9	365	7,844·7	507·58
Falconite Iris ..	G. E. Yelchich, Waiuku ..	2 13	241·8	365	8,424·7	494·12
Merivale Aster ..	A. R. Gudopp, New Plymouth	2 7	241·2	365	8,797·8	485·61
Waipiko Kasino ..	S. H. Wearing, Richmond..	1 282	240·5	356	7,798·2	472·80
Rydal Blue Bell ..	T. M. Remington, Westmere	1 302	240·5	365	7,463·0	428·77
Craigalea Ruby ..	J. G. Robertson, Eltham ..	2 19	242·4	333	6,320·1	405·40
Silverlea Myrtle ..	W. D. Ross, Morrinsville ..	1 350	240·5	365	8,083·7	401·93
Beechlands Fortune Lady	A. Moreland and Son, Te Rapa	1 338	240·5	365	6,819·7	401·10
Orange Pet's Maid ..	W. T. Williams, Pukehou ..	1 303	240·5	365	7,757·6	390·92
Awaroa Dolly ..	Geo. Bright, Otaua ..	2 80	248·5	365	6,174·4	387·32
Fairlands Pretty ..	J. Klenner, Kaimata ..	2 37	244·2	331	6,106·0	383·50
Sea Lion's Choice ..	H. H. Phillips, Te Rehunga	1 342	240·5	305	7,101·2	380·22
Cowslip's Pearl ..	W. T. Williams, Pukehou ..	1 310	240·5	364	7,796·7	374·42
Tirohia Rosabelle ..	B. E. Veale, Tirohia ..	2 24	242·9	365	7,011·8	373·42
Surprise Packet ..	Geo. Bright, Otaua ..	1 358	240·5	365	6,765·4	368·38
Beechlands Gay Lady	A. Moreland and Son, Te Rapa	2 12	241·7	365	5,722·5	365·23
Mountain Meadows Rata	F. V. Green, Brixton ..	1 303	240·5	362	5,885·3	355·81
Jersey Brae Pansy ..	H. E. Focke, Te Awamutu	2 14	241·9	337	6,280·6	350·37
Grasmere Gala ..	H. J. Berry, Kaupokonui ..	2 0	240·5	364	7,091·6	347·98
Gowanlea's Elf's Maid	John Robb, Westmere ..	2 20	242·5	365	5,883·6	346·93
Beechlands Lady Emma	A. Moreland and Son, Te Rapa	2 19	242·4	300	5,935·0	342·22
Grasmere Prudence ..	H. J. Berry, Kaupokonui ..	1 356	240·5	342	6,206·1	329·98
Beechlands Joyful Lady	A. Moreland and Son, Te Rapa	2 41	244·6	324	4,995·5	311·14
Fairlands Stellata ..	J. Klenner, Kaimata ..	1 358	240·5	327	5,151·6	310·47
Queen of Pearls ..	A. Buchanan, Palmerston N.	2 7	241·2	365	5,650·7	307·00
Jerseydale Twilight ..	John Pettigrew, Pihama ..	1 323	240·5	269	5,474·6	268·62
Tongahoe Margaret ..	R. Hicks, Hawera ..	2 29	243·4	298	5,277·2	256·63
Waipuna Luna ..	H. C. Wallace, Tamahere ..	1 360	240·5	305	4,414·0	242·60

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
JERSEYS—*continued.*						
Senior Two-year-old.		Yrs. dys.,	lb.		lb.	lb.
Craigalea Diamond ..	J. G. Robertson, Eltham ..	2 353	275·8	365	9,036·1	542·35
Glenavon Holly ..	J. Townsend, Puni ..	2 108	251·3	333	7,858·4	482·24
Lapwing of Heathcote	Mrs. E. E. Norton, Waimauku	2 318	272·3	365	8,191·5	460·26
Roma Lady Agnes ..	J. S. T. Short, Hawera ..	2 133	253·8	349	7,229·8	457·87
Edgarley Elegance ..	T. A. Millear, Tuakau ..	2 297	270·2	308	7,262·3	428·48
Jersey Brae Perfect Lady	H. E. Focke, Te Awamutu	2 132	253·7	292	7,745·2	380·00
Edgarley Delight ..	T. A. Millear, Tuakau ..	2 284	268·9	319	7,022·8	339·23
Merrie Meade Rani ..	H. C. Grierson, Papatoetoe	2 331	273·6	330	5,944·0	309·05
Three-year-old.						
Monandria	A. E. Watkin, Takanini ..	3 318	308·8	358	12,409·6	737·38
Alfalfa Senorita ..	A. E. Watkin, Takanini ..	3 254	302·4	365	12,974·2	725·84
Mac's Queen ..	A. E. Watkin, Takanini ..	3 345	311·5	365	11,396·9	632·24
Swan's Fox's Moo-o	A. E. Watkin, Takanini ..	3 36	280·6	365	9,789·7	606·34
Uruti Princess ..	W. Oxenham, Uruti ..	3 65	283·5	322	9,743·4	578·12
Tecoma Lady Sheen..	Mrs. E. E. Norton, Waimauku	3 3	277·3	365	8,949·3	564·27
Brooklyn Golden Rosette	H. J. Lancaster, Glen Oroua	3 321	309·1	365	9,686·9	550·51
Brooklyn Golden Lassie	H. J. Lancaster, Glen Oroua	3 316	308·6	365	9,095·7	543·93
Ku Ku Ranch Queen	R. L. Horn, sen., Ohau ..	3 339	310·9	335	10,238·4	471·11
Craigalea Adelaide ..	J. G. Robertson, Eltham ..	3 36	280·6	365	8,234·5	456·79
Braeside Sunbeam ..	J. Mitchell, Woodville ..	3 85	285·5	365	7,121·6	446·28
Hilltop Star ..	J. R. McDonald, Levin ..	3 87	285·7	333	6,911·8	403·59
Matai Nui Rosemary	D. L. A. Astbury, Mangatoki	3 316	308·6	269	6,067·6	335·79
Four-year-old.						
Gowanbrae K.C. Bluebell	A. G. Griffin, Richmond ..	4 319	345·4	365	13,794·8	685·66
Jersey Brae Favourite	A. E. Watkin, Takanini ..	4 40	317·5	365	11,072·0	593·12
Silver Dollar ..	G. S. Clarke, Te Awamutu	4 265	340·0	364	9,257·4	589·06
Waipiko Carauna ..	C. G. C. Dermer, Waipiko ..	4 275	341·0	365	10,555·0	570·17
Mature.						
Ivondale Dimple ..	P. J. Petersen, Brixton ..	5 15	350·0	365	10,756·2	739·09
Grafton Carnation ..	E. Feilding, Drury ..	8 38	350·0	365	13,024·2	728·29
Joli Bijou	A. J. Hale, Hillsborough ..	8 84	350·0	365	11,910·4	713·49
Salamis	F. W. and H. M. Clough, Inglewood	6 319	350·0	365	10,707·25	699·88
Jersey Meadows Iris..	H. H. Phillips, Te Rehunga	7 12	350·0	365	11,848·3	652·51
Fernaig Damsel ..	A. E. Watkin, Takanini ..	6 331	350·0	365	10·987·6	635·05
La Primavera ..	S. H Wearing, Richmond ..	6 25	350·0	365	12,130·7	628·49
Bachelor's Fairy Queen	J. R. McDonald, Levin ..	6 140	350·0	365	8,995·5	583·21
Lady Pattie ..	A. E. Sly, Whakaronga ..	9 163	350·0	365	10,786·5	562·31
Jersey Lea Friskey ..	S. Bowker, Ihakara ..	5 37	350·0	365	9,113·9	542·01
Ururoa	F. V. Green, Brixton ..	6 23	350·0	334	8,464·5	534·05
Wisp's Beauty ..	W. Muir, Waihi	7 68	350·0	365	10,026·4	498·46
Pilot's Gem ..	T. Brownlee, Pukekohe ..	5 347	350·0	365	7,451·2	488·02
Edgarley Gold ..	T. A. Millear, Tuakau ..	5 335	350·0	365	8,385·9	462·75
Golden Tilly ..	J. R. McDonald, Levin ..	5 2	350·0	311	9,354·8	450·30
Glyndyfrdwy Belle ..	H. E. Walters, Waitoa ..	8 354	350·0	356	7,077·6	439·12
Ivondale's Clematice	A. J. Luxton, Omata ..	5 356	350·0	363	8,362·0	423·73
Snow View Snowflake	A. R. Gudopp, N. Plymouth	5 280	350·0	345	6,041·1	411·05
Larking	R. Hicks, Hawera ..	5 17	350·0	302	6,677·8	384·64

GOWANBRAE K. C. BLUEBELL (A. G. GRIFFIN, RICHMOND).
C.O.R. in Jersey four-year-old class: 13,794·8 lb. milk, 685·6 lb. butterfat.

DOMINION LUCILLA OF RUAKURA (R. S. ALLAN, HATUMA).
C.O.R. in Milking Shorthorn senior four-year-old class: 14,850 lb. milk, 635·9 lb. butterfat.

LIST OF RECORDS—*continued.*

Name of Cow and Class.	Tested by	Age at Start of Test.	Fat req'd for Cert.	Yield for Season.		
				Days.	Milk.	Fat.
FRIESIANS.						
Junior Two-year-old.		Yrs. dys.	lb.		lb.	lb.
Totara K.P. Lena Lass†	Piri Land Company, Auckland	2 117	252·2	309	11,358·3	452·42
Tikorangi Pearl No. 1	W. Bevan, Manukau ..	2 31	243·6	279	7,892·4	290·60
Senior Two-year-old.						
Ryvington Pontiac Cheer	Mrs. A. M. Hodgson, Tamahere	2 311	271·6	365	11,590·2	433·97
Junior Three-year-old.						
Pareora Hero Fancy*	A. S. Elworthy, Timaru ..	3 14	278·4	365	15,808·1	600·86
Ryvington Pontiac May	Mrs. A. M. Hodgson, Tamahere	3 16	278·6	365	11,166·4	433·20
Mature.						
Rosevale Burkeyje Sylvia*	North and Sons, Omimi ..	8 38	350·0	365	14,766·2	523·23
MILKING SHORTHORNS.						
Senior Four-year-old.						
Dominion Lucilla of Ruakura*	R. S. Allan, Hatuma ..	4 325	346·0	365	14,850·0	635·91
Mature.						
Newstead Lucy* ..	E. Ridgley, Ridgway, Waiuku	14–15 years	350·0	365	19,864·5	748·21
AYRSHIRES.						
Mature.						
Maesgwyn Hazel* ..	C. B. Morgan, Woodville ..	7 59	350·0	365	20,723·4	695·44
Velma of Edendale ..	W. Hall, Lepperton ..	6 10	350·0	365	12,889·0	444·13
RED POLLS.						
Two-year-old.						
Otahuna Nancy* ..	G. S. Young, West Plains ..	1 315	240·5	309	7,744·0	291·99
Otahuna Countess* ..	G. S. Young, West Plains ..	1 349	240·5	292	6,601·4	276·79

Noxious-weeds Order.—The Mauriceville County Council has declared, with respect to its territory, that Californian thistle is *not* a noxious weed, and that gorse and pennyroyal are noxious weeds under the Act; further, that all its previous declarations regarding noxious weeds are revoked.

Importation of Animal-manures.—The annual report of the Live-stock Division for 1925–26 states that during the year the importation from Australia and India of animal-manures sterilized under supervision did not, for various reasons, come up to expectations. Considerable difficulty was experienced in obtaining freight to New Zealand for even small consignments, and in addition seamen's and railway strikes in Australia hampered, and at times entirely suspended, business in this direction with New Zealand. The organization in regard to the supervision of the sterlization of animal-manures from India and Australia has been maintained, but it is a matter for consideration whether, in view of the limited imports to New Zealand of animal-manures, the Department should not now withdraw its organization from one at least of these countries and so confine the source of supply to one place.

SETTING AND ADJUSTING OF LEVER PLOUGHS.

SEVERAL correspondents have lately drawn attention to the very common lack of knowledge on the part of the average ploughman as regards the setting, &c., of his plough. At our request the following useful notes on how to set and adjust lever ploughs for work have been kindly contributed to the *Journal* by a practical expert in farm implements :—

First fit on the shares. Then measure from bottom of point of shares to top of beam, next from bottom of back wheel to top of beam, then from bottom of front wheel to top of beam. These measurements should all be the same, so that the plough will be on the level. It is most important to note that if a plough is worked with both front and back wheels, or either of them, $\frac{1}{2}$ in. or $\frac{3}{4}$ in. higher than the share level, the draught is increased enormously. Therefore it is imperative to keep the plough at the levels mentioned.

In soft ground the wheels may be set a little lower than the point of the shares, but *never higher*, unless in striking out or in finishing, when the front wheel may be altered to suit. The back wheel must always be kept at its proper level. The depth of furrow is got by adjusting the land wheel alone.

When ploughing on hillside the skeiths should be set up off and well back over the shares. A straight-edge placed along the bottom side of back wheel should run towards the land about $2\frac{1}{2}$ in. to 3 in. at the point of share. Then as the plough slips downhill the back wheel works up and regains the lost ground. In hillside work it is also advisable to use narrow shares and turn the widest furrow possible, according to the class of land being ploughed.

In ordinary ploughing never cut the furrow right through, as this is inclined to stand the furrow on edge ; about $1\frac{1}{2}$ in. to 2 in. break is required. This means that if shares 9 in. wide are being used the plough should be opened out at the front wheel crosshead to between $10\frac{1}{2}$ in. and 11 in., and the *break* is the difference between the width of the share and the actual furrow ploughed.

The skeiths should be set about $\frac{1}{2}$ in. to the land side of the share, and about 1 in. (more or less) *above* it, according to the class of ground being ploughed. In hard or stony ground the skeiths should be lifted up off the shares and well back over them. In soft ground this should be reversed—skeiths well forward and well down.

It will be noticed that when the back wheel wears the back furrow gets smaller, and that when the front wheel wears the front furrow gets larger. To remedy this tie top of back wheel to beam of plough, then place straight-edge from land point of share parallel with the beam to the back wheel ; next fit in packing to adjust the back wheel until it goes over against the straight-edge. This is called the "line of draught," and is vital to the good working of the plough. When the back wheel gets worn, or the back-wheel stalk gets bent, the plough swings round towards the furrow and will not hold the land. Next adjust the front-wheel crosshead stalk until both furrows are the same width.

Before starting work it should be seen that all wearing parts of the plough, such as skeiths and wheels, are properly oiled or greased.

SEASONAL NOTES.

THE FARM.

CEREAL HARVEST.

MOST of the cereal crops will be ready for cutting during January, and any slack days during the early part of the month can be spent profitably in overhauling binders. Canvases should be repaired, knives sharpened, damaged parts replaced, oil-holes cleaned out, and the whole machine thoroughly oiled. This will probably save a good deal of time and worry during cutting operations.

Oats should be cut somewhat on the green side, and allowed to ripen in the stook. Wheat should be cut when all straw except a small portion above the highest knot is yellow; knots should be green, and grain firm enough to cut with the thumb-nail. Barley must be fully ripe before it is cut. The straw should be free from any trace of greenness, and when this stage is reached the grain will have assumed a finely wrinkled appearance.

Care should be taken in stooking, for this is an important operation, and if carried out in the correct manner will save much waste. Sheaves should not be allowed to lie long on the ground; it is advisable for cutting and stooking to proceed simultaneously. If the sheaves contain much green rubbish they should remain in stook until all this is dead; otherwise they will heat in the stack and the grain be damaged. A better sample of grain and one more appreciated by the miller is obtained if crops are stacked and allowed to mature before threshing. If stook-threshing is carried out special care must be taken to see that the grain is in fit condition.

CATCH-CROPS.

As the coming month advances, and stubbles or land which has grown early soft turnips or other fodders becomes available, every endeavour should be made to get in suitable catch-crops. It should be remembered that vacant land encourages weed-growth, if not already present, when the crops are removed. Weed-growth at this period is often in a comparatively weak state, and is easily killed with a minimum of cultivation if the weather is at all seasonable. Unless such weeds are of a particularly persistent nature there will be no need of a bare fallow. Where conditions necessitate ploughing, this should be very shallow in order not to unduly dry out moisture, but in many cases grubbing will be sufficient.

If it is intended to autumn-sow grass there may still be time to provide a quick crop like mustard for ploughing in, which is of great advantage on light-textured soils. A suitable sowing is 12 lb. to 15 lb. mustard with 2 cwt. to 3 cwt. of super per acre.

Land not required until spring can be sown with Black Skinless barley for very quick results, or for later feeding with Algerian oats and Scotch tares; a temporary pasture of Italian or Western Wolths rye-grass and clover is an alternative. Sow 2 bushels to 2½ bushels of Black barley, or 2 bushels oats and 1 bushel tares, or 30 lb. of either Italian or Western Wolths rye-grass, or 15 lb. of each with 5 lb. or

6 lb. of red clover, using in all cases 2 cwt. to 3 cwt. of super or other suitable phosphatic manure.

PREPARING FOR AUTUMN SOWING OF GRASS.

The preparation of areas to be sown down in permanent pasture during autumn should now be kept in view. While many factors are important in the establishment of a good pasture, it must be admitted that late ploughing and hurried cultivation are the cause of many failures. A properly sweetened and consolidated bed is imperative, and this cannot be attained by hurried rolling and working alone. As with all cultivation, nature must be permitted to do her share; hence it is necessary that preparation should be commenced at least a few weeks before sowing. Varieties to constitute the mixture should be chosen with care and suited to the particular conditions of soil and climate.

As the maintenance and permanency of good pastures is becoming better understood, greater care in laying down permanent grassland must follow. Top-dressing, although valuable and important, will give its best results at a later date where the pasture has been properly established. If grass is to follow a crop eaten off by sheep, and provided the land is clean, it is often better to disk rather than plough, in order to retain consolidation and keep the animal-manure near the surface.

TURNIP AND RAPE CROPS.

Sowings of yellow- and white-fleshed turnips for late winter feed may be made in January. Of the former, Purple-top and Green-top Aberdeen do best in the wetter and colder districts, while of the latter, Lincolnshire Red and Imperial Green Globe are suitable where the average annual rainfall is below 30 in. Late sowings of rape may also be made. When this is done it is usual in various districts to drill in Western Wolths rye-grass at the same time. This supplies late autumn and early spring feed.

The earlier-sown rape crops should now be ready for feeding off. Ewes and lambs or newly weaned lambs are best turned on when the leaves are a bluish-purple in colour. Care should be exercised in the feeding of this crop, or losses are likely to occur. Stock should not be put on when they are very hungry or when the crop is wet, else they are liable to become blown. It is safest to commence feeding on small blocks, and only for a short time. Lambs on rape should have a good pasture run-off.

SUPPLEMENTARY FEEDING OF DAIRY COWS.

The period following New Year is often the most critical period in the dairy-farmer's calendar. December sees most of the grasses reach maturity, and with normal summer weather the next few weeks show a marked decline in the production of the pastures. This coincides with and tends to encourage the natural tendency for the cows to dry off, or at any rate to markedly drop in their milk-yield, and a good supply of succulent food coming forward as the pastures decline will make all the difference in butterfat-production. Lucerne, maize, Japanese millet, and early-sown soft turnips provide very useful January feeding. Ensilage, too, acts as an excellent brake on the downward trend of production.

PEAS FOR LAMB-FATTENING.

Where peas are grown for lamb-fattening a start should be made to feed off when the main crop of pods are full and just getting hard. If stocked earlier lambs do not like them and there is considerable waste. If the weather continues dry practically every pea will be picked up from the ground. Lambs should not be confined on pea crops at first, as it takes them a little time to get used to the peas, and during the first week they should have access to other feed to keep them going. After about a week the peas are readily eaten and the necessity for other fodder is not so great. At the same time lambs fattening on peas will always do better if they have a run-off. They should also be provided with plenty of drinking-water.

LUCERNE.

Young lucerne stands may require mowing towards the end of January or beginning of February. It is better to allow the young plants to strengthen than mow too early, unless weed-growth is likely to be troublesome. Provided the weather is dry, old stands should be thoroughly cultivated to eradicate grass, &c., as opportunity offers after mowing. Young stands should be given light cultivation as they become better rooted, with the same object in view. Grazing of well-established stands by stock should be carried out in blocks, as lucerne will not stand constant nibbling.

Lucerne may be sown up to the end of February, at the rate of 10 lb. to 12 lb. in 7 in. drills or 6 lb. to 8 lb. in 14 in. drills. On average soils a covering of $\frac{1}{4}$ in. to $\frac{1}{2}$ in. is sufficient, and even on sandy soils the depth should not exceed 1 in. The failure of many crops to germinate well has been due to too deep sowing. —*Fields Division.*

THE ORCHARD.

SPRAYING.

It will be necessary to continue spraying in accordance with the instructions set out in the calendar published in the September *Journal* notes. All fallen and codlin-moth-infested fruits should be gathered and destroyed immediately, so as to prevent the escape of the grubs from the fruits. If this is done it will greatly assist in controlling this pest. The cherry and pear slug will now be in evidence, and two or three sprayings with arsenate of lead should effectively keep the pest in check. On cherry-trees on which the fruit is nearly ripe it is advisable to use hellebore powder, 1–20, as it does not stain the fruit as does arsenate of lead. In orchards where red mite, apple leaf-hopper, and aphis are in evidence every effort should be made at this period by thorough and careful sprayings to control these pests.

During the spring and early summer months cold and showery weather has been generally experienced, and in consequence such fungous diseases as brown-rot of stone-fruits and black-spot of the apple and pear will be prevalent in localities where these diseases are established. For the control of brown-rot it is necessary to supplement the spraying programme by carefully going over the trees

frequently and cutting out all infected laterals, shoots, and other wood. The trees should be sprayed thoroughly up to within a fortnight of picking.

DISBUDDING.

This operation should be regularly attended to now, and all shoots below the grafts removed. All superfluous shoots should also be removed from the roots and trunks. Surplus and misplaced growth in the heads of the trees—particularly young trees—should, if not already attended to, be carefully cut out or pinched back now.

BUDDING.

The reworking of trees by budding may be carried out from the middle of January until the end of February. Budding is merely a form of grafting in which buds are used instead of scions. Each bud is an individual plant, and under certain conditions is capable of forming a tree. The operation may be performed in various ways, but the usual and most general way is by what is termed shield or T budding. To do this make a straight perpendicular cut in the bark of the stock about 2 in. long, and at the top a cross cut so that the two cuts form a T. Raise the bark from the top with the point or the handle of the budding-knife, so that the bud may be inserted. Push the bud down as far as required, and tie carefully with raffia. Only mature buds should be used. The buds are prepared by cutting them with a sharp knife from the shoot, with a portion of the bark and a thin piece of wood attached. Cut the top of the bark square. Care must be taken in cutting that the bud is not injured when it is removed from the shoot. The leaves should be cut off, leaving a portion of the stalk to assist in holding the bud when it is being inserted into the stock.

PICKING.

The harvesting of stone-fruits will have commenced, and it is important that every care should be exercised in the handling of the fruits. It is also necessary that they should be well graded, and packed in the most attractive manner possible. The states of maturity at which these fruits should be picked were dealt with in the November *Journal* notes. The earliest-ripening varieties of apples will soon be ready for picking. The matured fruits should be selected from the trees as soon as they are ready, and sent to market, as remunerative prices are usually obtained for these early fruits. Small and immature fruit should not on any account be picked, but should be left on the tree to mature. —*W. K. Dallas, Orchard Instructor, Dunedin.*

Citrus-culture.

Cultivation of the soil should be constantly attended to at this period. It is not desirable to allow to grow between the trees any crop which would draw in the moisture of the soil during summer—not even weeds. Clean and constant cultivation all summer should be the aim. On no account should a heavy crop of green material be turned under during dry weather. It is best dealt with by a few strokes of the disks, when it will be worked into the surface soil. If ploughed in it will form an insulating stratum of undecayed matter between the surface and lower soil.

Spraying: During the coming month the main crop of oranges and lemons will be at the most critical stage for the season, with young, tender, and rapidly developing fruits which require protection against thrips, mites, and young scales that are apt to become established at this period. The lengthy flowering-period of the lemon results in fruits developing after the main crop has set and been sprayed for scab and verrucosis. Repeat applications of 4–4–40 bordeaux are therefore necessary in order to ensure all fruit being protected from the early stages. Suitable sprays for insects are oil, 1–60, or nicotine, 1–800. The latter may be added to any bordeaux spray being applied, or 3 lb. soap for 100 gallons should be added if used alone.

Pruning: At this season many undesirable growths of rank wood are made on the inside of the trees. These should be cut out, being of little fruiting-value and causing overcrowding. Extending growths are also made by the main parts of the tree, often extending 2 ft. to 3 ft. before natural division takes place. Such growths should be dealt with by pinching at 12 in. to 16 in. in length so as to cause the division at a more suitable place. Attention to this work when the shoots are young obviates the necessity for later hard cutting to bring the extended growths within bounds.

—W. H. Rice, Orchard Instructor, Auckland.

POULTRY-KEEPING.

CLEANING UP AFTER HATCHING AND REARING.

Now that the work of hatching and rearing is over, all incubators and brooding-appliances should be thoroughly cleaned and disinfected before being set aside. Lamps should be well scoured in boiling water. In addition, the regulating-appliances of the incubator should be disconnected and placed inside the machine. This will prevent these parts from becoming damaged, which is too often the case during the off season. Especially does this apply to the connecting-rod, and when things are thrown carelessly on top of the machine. Once a connecting-rod becomes bent it can never be depended upon, and is obviously a common cause of incubators not regulating properly and producing poor hatches.

The brooder runs should also be dug up, limed, and sown down, everything being done, in fact, to ensure for these a clean condition and a good growth of grass next spring.

BROODING DUCKLINGS.

Several cases have come under my notice lately of ducklings losing the power of their legs during the brooder stage. This is usually the result of allowing the birds to sleep in damp quarters. Although ducks are water-fowl, ducklings produced under artificial conditions will cease to thrive if compelled to sleep on damp bedding or where a moist atmosphere exists.

Once a duckling loses the power of its legs little or nothing can be done for it. It is really a matter of prevention by checking everything that tends to create a moist atmosphere. In the first place, the drinking-vessels should be placed well away from the sleeping-quarters,

which will help to keep the latter dry. Ample ventilation should also be provided, and the quarters kept clean. Do not on any account overcrowd ducklings by placing more in the brooder than it can properly accommodate. Work only with numbers that can be handled with absolute confidence. An even degree of warmth, good ventilation, and dry and clean quarters are essential factors in rearing brooder ducklings.

Young ducklings should be always protected from hot sun, as, having a thin skull, they are very prone to sunstroke, which is a common cause of heavy mortality. When a duckling becomes affected with sunstroke it gives every appearance of being in a fit. It will be observed to fall on its back, with the eyes twitching, and generally presenting a distressed condition. Ducklings which have had a long fast and are then given food and water will often behave in a similar manner, and with heavy mortality.

The only way of preventing this trouble is to have water within reach of the birds at all times, both by day and night. Where it is found that the drinking-vessels are empty, and the birds have been without water for some time, it is a good plan to take the chill off the water before giving it to the birds to drink.

LEG-WEAKNESS IN BROODER CHICKENS.

Several complaints have reached me of chickens being affected with leg-weakness. This trouble usually affects the young birds when from three to five weeks old, and, apart from the loss of leg-power, they often present a healthy plump condition. At first the affected birds will have an unsteady walk and a slight spreading of the legs. From then onward the legs gradually get weaker, until the bird is unable to stand. Even at this stage they may still bear a healthy bodily appearance, and will eat greedily if food is placed before them. Leg-weakness is often confused by poultry-keepers with rheumatism, and in their endeavour to effect a cure they rub the legs with liniment, &c., but seldom or never with the desired effect. This trouble is usually due to huddling and the need for greater warmth. The huddling effort and the desire of the chickens to secure an inside position, which is necessarily the warmest, has the effect of spreading their delicate legs. The trouble is often intensified by insufficient bedding on the floor of the brooder, especially when the floor is very smooth—the constant slipping on the smooth surface having the weakening effect on the legs.

There is practically no way of curing leg-weakness—prevention is the only feasible way of dealing with it. The first step to this end is to provide the desired warmth demanded by the chickens. This will induce them to spread out over the floor of the brooder—a sure indication that they are enjoying the comfortable degree of warmth that instinct demands. It is also a good plan to place a piece of sacking over the floor of the brooder on which the bedding —chaff, &c.—is placed. This will give the chickens a foothold in the event of their huddling, and prevent slipping and its consequent effect on the legs. In addition, the chickens should be provided with plenty of exercising-space, as without this, in the case of chickens when about a month old, the body is apt to become too heavy for the delicate legs to carry, and as a consequence the latter become affected.

CLEAN GROUND ESSENTIAL.

In these days of progressive ideas in poultry-culture one of the most important facts evolved is the necessity of clean ground for the maintenance of healthy stock. This necessity is of special importance in the raising of brooder chicks. Not only should the brooder runs be kept clean and fresh, but every possible provision should also be made to place the young birds on fresh ground when they are drafted from the brooder. Dirty or what might be termed poultry-sick soil means the encouragement of disease and parasitic life, and these come into the category of those things which cannot be properly cured. Too many poultry-keepers are not aware that intestinal worms are often responsible for heavy losses in comparatively young chickens, say, from six to eight weeks old. Scores of such cases have come under my notice, and in almost every one the trouble could be traced to tainted ground.

Above all, never allow chickens—or, indeed, poultry of any age—to have access to a manure heap which has been collected from time to time out of fowl-houses, or intestinal parasites are almost sure to give trouble. On one plant where my advice was sought in regard to mortality among chickens, and where the natural method was adopted for hatching and rearing, the owner declared that the young birds did well till the hens and their broods were let out of their coops and given a free range. The cause of the trouble was not far to seek, for immediately a hen and chickens were let out of their coop they made straight away to a manure heap. This not only consisted of cleanings from poultry-houses over a long period of time, but in addition it was made the dumping-ground for dead carcases of fowls and practically all kinds of rubbish. In the circumstances it was little wonder that heavy losses were taking place, due to intestinal worms.

It must again be emphasized that if the young birds are to develop into vigorous and profitable stock they must have everything in their favour, and I do not know of anything more conducive to this end than clean ground to run on. I have always favoured alternate runs to a poultry-house, in order that the birds may have frequent changes to clean ground after it has been cropped and rested. Longer experience in utility-poultry keeping has only strengthened, to my mind, the importance of this practice.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

SUPERS.

WHEN the honey-flow commences everything should be in readiness to take advantage of the too often brief season. Care should be taken that sufficient supers are on hand to care for the largest crop. Failure to make provision beforehand loses the industry many tons of honey in a good season. During bad seasons the beekeeper is apt to neglect his equipment and otherwise allow his stocks of supers to become depleted. This is bad policy, as supers can be stored without injury, and when the big yield comes repay their cost many times over. Do

not allow the bees to loaf or cluster outside for want of room. The work of adding supers must not, however, be done in a haphazard manner, nor the bees be disheartened by being given too much room at one time. The supering of weak colonies taxes the bees in keeping up sufficient warmth in the hive on cold nights, and prevents them from building up. It is well when adding additional supers to place them between the brood-chamber and the first super, or at least to raise a few frames of honey from the first super into the second when adding the latter.

QUEEN-EXCLUDERS.

January is the month when queen-excluders are of most use, especially in southern districts. Whatever their disadvantage may be in some localities, in the South they have proved their efficacy in enabling the apiarist to finish extracting before the hot weather goes, without the destruction of any brood whatever. They should never be used for general purposes until the main honey-flow is in full swing. By that time the bees are used to working in the supers, and with nectar in abundance to be had all around them they will work cheerfully right through the hive, passing through the holes in the excluders as if no obstruction existed.

The best method of using the excluders is as follows: All sealed brood should be raised above the excluder, and the queen confined below on drawn-out combs. The brood above the excluder should be watched for a few days in case any eggs have been elevated, as the bees will sometimes attempt to raise queen-cells above the excluder. If this happens the queen-cells should be destroyed, as the queens which will emerge from them will not be able to pass through the excluders to get mated, and will in time develop into drone-layers. By providing the queen with plenty of empty comb she will be able to cultivate laying at a sufficient rate to keep up a supply of workers, and as the brood hatches out in the upper stories the cells will be at once filled up with honey.

Excluders are often condemned as being productive of overswarming, but in many localities swarming ceases automatically as soon as the main honey-flow commences; and if the queen is allowed plenty of room in the brood-chamber, and the brood in the supers is carefully watched for the production of queen-cells, very little harm can come from the use of excluders, while the immense advantage of being able to extract combs entirely free of brood is worth a great deal to the apiarist at his busiest season.

VENTILATION.

The matter of providing ample ventilation must not be overlooked, for at this season of the year bees require abundance of fresh air day and night. Clear the hives of weeds and grass. Strong colonies may be given full-sized entrances. If the bees show a tendency to cluster at the entrance ill-ventilated hives may be the cause. This condition is a factor in excessive swarming, and in any case a large force is employed in carrying out work which can be obviated to a large extent if the beekeeper will study the requirements of his bees. In cases where the bees show a tendency to cluster at the entrances the front of the hive may be wedged up an inch or so. When honey is coming in freely there need be no fear from robbing.

HONEY-TANKS AND HEALTH REGULATIONS.

At this period, when making preparations for the handling of the season's crop, it is well for beekeepers to contrive to meet the demands under the regulations in relation to the storage of moist foods. Section 21, subsection (1), of the regulations under the Sale of Food and Drugs Act, 1908, provides that no person shall use in the preparation, packing, storage, or delivery of food for sale any package, container, or appliance used for manufacturing, keeping, or holding a moist food which has in contact with the food a surface composed of lead or zinc. Since honey is a moist food, the above regulation clearly prohibits its preparation and storage in tanks and extractors the metal parts of which have in contact with the honey a surface composed of lead or zinc.

Prior to the war tinned-steel containers were almost exclusively used by beekeepers for the storage of their product. The scarcity and high price of tinplate led the manufacturers of beekeepers' requirements to utilize galvanized iron, and thus to-day a large number of honey-tanks constructed of this material are in use. The advice given by the Health Department that all such vessels should be scrapped, and the additional warning that the regulations are to be enforced, cannot be treated lightly or ignored. There is a danger that honey stored in vessels the surface of which is composed of lead or zinc may be contaminated and its quality thus destroyed. The safest course to follow is to scrap all such containers and install new equipment in time to handle the season's crop. Where arrangements cannot be made to do so immediately, it is recommended that precautions be taken to coat the inner surfaces of the extractors and tanks with beeswax; but while this will guard to some extent against the danger that exists when honey is exposed to deleterious metals, it should be treated as a precautionary measure only, and should not deter beekeepers from installing equipment that will comply with the regulations in force.

REGISTRATION OF APIARIES.

Beekeepers are reminded of the necessity of applying for the registration of their apiaries, which is being called for in compliance with the regulations under the Apiaries Act, 1913. Cards of application have been despatched to all beekeepers in the departmental register, but should any person requiring same not receive a card he should make immediate application for one. The cards are obtainable from the principal district offices of the Department of Agriculture, from the Director of the Horticulture Division, Wellington, or from any of the larger post-offices throughout the Dominion. Registration is free; the penalty for non-registration is a fine not exceeding £5. Beekeepers are requested to note that provision has been made on the registration card for a declaration as to the quantity of honey and beeswax produced during the season ended 31st May, 1926. This information is being sought through the Department by the Government Statistician under the Census and Statistics Act, 1910. In the circumstances beekeepers should appreciate the need of prompt and accurate returns being rendered as early as possible.

—E. A. Earp, Senior Apiary Instructor.

HORTICULTURE.

THE TOMATO CROPS.

AFTER visiting a number of tomato-growers early in the season one is impressed by the heavy losses incurred by the neglect in regulating the temperatures and humidity in frames and glasshouses, and chilling plants by putting them out in the field without properly hardening them first. An average crop is sometimes obtained under these circumstances, but late in the season, and more often even that result is missed through a poor setting of the fruit or serious attacks of disease. It is no doubt a fact that most of the disease among such crops is due to wrong cultural methods, which cause debility and allow plants to become an easy prey.

Among the wonders of organic life nothing exceeds the physical adjustments a plant makes to accommodate itself to changes of temperature and humidity; the functions are retarded or accelerated, and the leaf-surfaces are enlarged to increase the transpiration of moisture. But with the grower's object of a large and early crop the energies of the plant cannot be allowed to be taken up by such adjustments; the objective can only be fully attained by steadily maintaining the optimum conditions, and for the tomato-plant these are a temperature of 55° to 65° F. and a dry buoyant atmosphere. To produce early plants under the changing weather conditions of early spring, when one is busy with many other duties, is not easy, but it is necessary. It is best done by having the frame-yard in a handy central position, and some one appointed to specially attend to ventilation and watering; it is a duty requiring the greatest skill and experience.

Much has been said of late regarding the necessity of giving more ventilation to the tomato crop when grown under glass, so as to prevent the early development of leaf-mould fungus on the foliage. But to have bottom and top ventilators open when a cold wind is blowing and chilling the plants is to weaken them and make them an easy prey to disease. The one excess is equally as bad as the other. When plants have been well grown in the frames, to place them out in the cradles to harden, or plant them in the open without proper preparation, is entirely defeating the object in view. The hardening process should be graduated by giving more ventilation in the frames as the weather becomes warmer, and when the plants are placed in the cradle to harden a hessian cover should be handy to shelter them from sudden storms or fall in temperature. If exposed at this period to any sudden change the growth is stopped, and the first bunch of blossom, which is of most value, is lost or seriously damaged.

In some instances, where plantings in the field are extended over a considerable period, it is customary to make one sowing and allow plants to remain in the boxes until they are required. The plants under this treatment do not die, but the check received seriously diminishes the crop or delays the harvest. For an extended planting-period several sowings should be made, so that plants may be taken from the boxes as soon as they are ready and before any check is given to their growth. Such attentions achieve the objects in view, and dispense with a lot of anxiety with disease and spraying and feeding backward plants.

BERRY-FRUITS.

Harvest in the berry-fruit section is drawing to a close, and it is to be remembered that the next season's crop largely depends on the autumn treatment of the plants. Strawberry-beds that are worn out may be ploughed under and the land prepared for other crops. Where the beds are to be carried on for another year they should be cleaned up and the plants encouraged to make good growth.

Raspberry and loganberry breaks will require to have the old fruiting-canes removed; and in all cases these crops should be carefully examined for any sign of disease or pests, and suitable sprays supplied now, as required, so that clean, well-grown fruiting-wood will be available for the coming season. Where further plantings are to be made the present is a suitable time to commence preparing the land by thoroughly cleaning it and giving it deep cultivation, as these shallow-rooting crops allow little of this kind of work to be done after they are once planted out.

THE VEGETABLE-GARDEN.

In the vegetable section many crops will now be ready for harvesting. When this is completed the land should be taken in hand, and if not required for immediate cropping it is best sown down in a suitable cover-crop for turning in later. The opportunity for administering this valuable manurial treatment should not be missed.

Among the crops harvested will be the early potatoes, and the grower will be well repaid by making a careful selection of seed tubers. They should be taken from well-grown plants true to type, the tubers being about the size of a hen-egg and slightly immature. The practice of storing seed potatoes in well-ventilated banana-cases is quite a good one. If stored in sacks care should be taken not to pile these up or to allow the tubers to heat in any way. In dry weather the danger of infection from potato-moth should be avoided.

If the weather at this season is wet, late blight in the main potato crop is sometimes troublesome. Experience has amply demonstrated the efficiency of bordeaux mixture, 4–4–40, applied fortnightly, to give a large measure of protection to the foliage and thus allow the tubers to complete their growth. The strength of the spray is sometimes increased for the later applications with good results.

Advantage of our mild autumn season may now be taken by sowing dwarf peas and beans, spinach, salads, turnips, early shorthorn carrots, and the popular beet-root.

The planting out of winter crops of savoy, cabbage, cauliflower, broccoli, kales, celery, and leeks should now be completed.

TOBACCO-GROWING.

Between two and three months after planting the terminal growths of tobacco-plants develop flower-buds, which are an indication that the vegetative growth has been completed and the business of seed-production has commenced. To prevent the deterioration of the leaves —which would quickly follow this development—the flower-buds are removed with as much of the remaining growth as is unlikely to produce well-developed leaves. This operation, known as "topping," should be carried out when the majority of the plants are in the right condition, and so avoid unnecessary traffic through the crop. At the

same time many growers "prime" the plants—that is, they remove three or four leaves from the base. These leaves are small, thin, soiled and broken, and generally useless. It is considered that by removing them the strength of the plant is concentrated in the more valuable leaves above. Another opinion is that these waste leaves are best left to protect the crop by keeping it up off the ground.

The check thus given to blossoming results, among other things, in a renewal of vegetative growth that takes the form of young shoots—usually called "suckers"—which develop in the axils of the main leaves. These must be removed before they attain a length of 3 in. Suckering is usually best done once a week, and may require to be repeated two or three times.

LAYING OUT HOME GARDENS AND GROUNDS.

The many new homes being erected in town and country demand consideration of the subject of the home garden. The present time is most suitable, as the autumn is the time above all others for carrying out this class of work, and as its success depends more than anything on careful study and consideration of the undertaking the scheme is best drawn up now. It is best to actually plan the proposals first on paper, as ideas, however good, may not harmonize, but when sketched out their association with each other can be studied.

The first idea to get hold of is that the purpose of a garden is not merely a sentimental regard for beauty. Although the removal of the feeling of newness and bareness about a new home is important it is comparatively incidental, and is best realized by attention to the practical amenities. For instance, as it is inconvenient and unsightly for pools of storm-water to lie for any time about the house, it is necessary to grade and drain the land, especially footpaths and approaches, and to metal them and provide sumps and culverts to carry away storm-water.

Shelter from prevailing winds and screens for unsightly views demand suitable blocks of trees and shrubs to be planted. For shade in summer and a certain amount of privacy further planting will be required, although distant and attractive views must not be obscured. In selecting these plants one's own preference should not be considered so much as the suitability of the shrubs and trees for the locality. Our primeval forests have taught us that each locality has its own natural plant associations, and best results are obtained by following nature in this respect. Not that it is necessary to confine oneself to planting only native trees, for exotics have the same preference for special localities, and these should be studied. A common mistake is to plant too many kinds of trees and shrubs, when variety could be better obtained by planting more varieties of the few special subjects that are suitable. If the locality is suitable for, say, lilacs and hydrangeas an uncommon and effective method would be to plant a number of the many distinct and attractive varieties of these plants that may now be obtained. In many localities where the soil is considered poor heaths and rhododendrons do well, and by planting well-arranged distinct varieties of those shrubs a small garden can be furnished well without planting much else.

Another lesson nature teaches that might well be considered here is the fact that instead of these trees and shrubs growing as isolated specimens they are usually closely associated in the wild state. The shrubs grow among the trees, and especially about the margin of plantations. The improved results from such close association are often very remarkable. Ferns and even many herbaceous plants prefer this partial shade, which is their natural environment. The contrast with the open grassed lawns is convenient and effective.

For the purpose of tennis and other games it is necessary to go to the labour of forming level greens, and on town sections these are appropriate. But in larger gardens and in the country the result will be equally good and frequently better if the grass surface is merely smooth and sown with dwarf permanent grasses found growing naturally in the locality.

—*W. C. Hyde, Horticulturist.*

FARM ECONOMICS WORK OF AGRICULTURE DEPARTMENT.

At the last meeting of the Board of Agriculture, held at Wellington, the Director-General, Agriculture Department, communicated to the Board an outline of the progress which is being made by the Farm Ecomonics Branch of the Fields Division in its investigations.

At the present time the work in hand embraces—(1) A survey of mixed farming in Canterbury; (2) an investigation into the cost of producing wool and meat, and their relationship to each other; (3) an investigation into the cost of producing butterfat.

In every case an endeavour is being made to study the whole farm as a unit, rather than follow a detailed system of cost accounting. From such a study it is considered that it will be possible to ascertain the per-acre production of a farm, and that by careful study the cost may be broken up fairly accurately into its respective branches.

Good progress is being made in Canterbury; offers of assistance are being received from sheep-farmers in the North Island; the dairy position is being investigated in the Manawatu, Wairarapa, and Waikato districts.

The Board was advised that some farmers are rather diffident about disclosing their financial position. It therefore considers it wise to point out that the identity of the individual furnishing information is lost in the Department, inasmuch as each form is numbered and the name of the person supplying the information does not appear on the form at all. In any case all information is treated as strictly confidential, and the Board therefore trusts that all those approached will assist the departmental officers to the best of their ability, as it is highly desirable, in the interests of producers as a whole, that accurate information concerning the cost of production should be secured and published.

Poultry-keeping as a Side-line.—"While there is ample room for the extension of large commercial plants," remarks the Chief Poultry Instructor in his annual report for 1925–26, "the industry holds out the greatest promise to the side-line poultry-keeper, especially to the small settler on the land. At the present time there are few farms in the Dominion where poultry are not kept on a moderate scale, but, unfortunately, in the majority of cases improvement is required both in regard to the quality of the stock and their management. It is a matter for regret that more farmers do not avail themselves of the free practical advice and assistance which is available to them per medium of the Poultry Instructors, and printed matter issued by the Department at a minimum of cost."

WEATHER RECORDS: NOVEMBER, 1926.

Dominion Meteorological Office.

GENERAL SUMMARY.

NOVEMBER is regarded as the last month of spring, and as such the month under record may be characterized as more than usually wet, windy, and cold. The outstanding feature of the month were the great floods in the Buller, Waimakariri, and Wairau Rivers in the first week of the month. The heavy rains at the end of the preceding month had soaked the land and swollen the streams, as well as leaving snow on the uplands, and when on 3rd November an extensive westerly low-pressure, laden with vapour, made its appearance many things combined to account for record floods. It rained every day from 27th October to 6th November in many places on the South Island west coast, and the falls were extremely heavy in the high country. Following are some of the daily falls recorded in the region mentioned :—

	3rd Nov. Inches.	4th Nov. Inches.	5th Nov. Inches.
Arthur's Pass	4·94	12·70	0·80
Greymouth	1·34	2·26	0·49
Reefton	1·96	2·28	0·50
Westport	1·40	1·91	0·31

Rainfall was in excess in all parts of the country, except in Hawke's Bay and some districts in Otago.

Thunderstorms, with hail, were reported in many places, and one in Hawke's Bay, on the 12th, did much damage to orchards.

Several light frosts occurred, particularly in the South Island, and the cold southerly wind which brought snow on the uplands on the 27th and 28th caused loss in newly-shorn sheep. Shearing and haymaking were greatly retarded, and growth in vegetation was backward for the time of year in many parts of the Dominion.

RAINFALL FOR NOVEMBER, 1926, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average November Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	5·36	17	1·50	3·27
Russell	4·32	15	1·90	1·61
Whangarei	4·03	15	1·77	3·41
Auckland	7·54	24	2·06	3·26
Hamilton	6·22	25	1·04	4·04
Kawhia	6·58	25	0·96	4·49
New Plymouth	6·89	21	0·88	4·61
Riversdale, Inglewood	11·20	23	1·48	8·95
Whangamomona	7·60	16	1·48	7·40
Tairua	5·10	20	1·62	3·55
Tauranga	5·73	20	1·58	3·29
Maraehako Station, Opotiki ..	5·10	18	1·24	2·78
Gisborne	3·56	9	1·29	3·02
Taupo	3·92	14	0·61	3·41
Napier	1·37	13	0·30	2·51
Maraekakaho Station, Hastings ..	1·62	14	0·44	2·03
Taihape	5·84	20	1·34	3·69
Masterton	3·19	13	1·23	2·73
Patea	8·38	20	1·91	3·72
Wanganui	4·24	12	1·32	3·31
Foxton	3·08	12	1·00	3·24
Wellington	4·83	20	1·49	3·42

RAINFALL FOR NOVEMBER, 1926—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average November Rainfall.
South Island.				
	Inches.		Inches.	Inches.
Westport	7·89	24	1·91	7·08
Greymouth	9·50	19	2·26	9·46
Hokitika	13·00	19	3·37	10·73
Ross	13·76	15	2·18	13·94
Arthur's Pass	33·11	21	12·70	15·00
Okuru, Westland	12·60	16	2·12	12·96
Collingwood	7·30	17	1·30	7·68
Nelson	3·74	17	0·89	2·93
Spring Creek, Blenheim	4·25	16	1·20	2·41
Tophouse	10·01	20	1·65	7·07
Hanmer Springs	6·55	15	2·36	2·74
Highfield, Waiau	4·00	10	1·12	2·52
Gore Bay	3·18	13	0·81	1·98
Christchurch	3·98	15	0·87	1·87
Timaru	2·46	13	0·90	1·96
Lambrook Station, Fairlie ..	2·40	12	0·48	2·00
Benmore Station, Clearburn ..	2·61	14	0·56	2·05
Oamaru	2·64	10	0·78	1·93
Queenstown	3·09	12	0·78	2·77
Clyde	1·13	10	0·28	1·36
Dunedin	4·04	19	1·01	3·27
Wendon	3·70	16	0·67	2·54
Gore	3·18	17	0·53	3·31
Invercargill	3·82	23	0·48	4·40
Puysegur Point	10·18	23	1·14	8·36

—*D. C. Bates, Director.*

BOOKS RECEIVED.

NEW ZEALAND FLOCK BOOK (SOUTH ISLAND): Volume xxii, 1926. Published by the Council of the New Zealand Sheep Breeders' Association (South Island), Christchurch.

RESEARCH AND THE LAND: An Account of Recent Progress in Agricultural and Horticultural Science in the United Kingdom. By V. E. Wilkins, Assistant Principal, Ministry of Agriculture. H.M. Stationery Office, London, 1926 (New Zealand Agents: Government Printer and Gordon and Gotch). Paper cover, 2s. 6d.; cloth, 3s. 6d.

ECONOMICS OF PRODUCTION OF GRADE A (TUBERCULIN-TESTED) MILK. By V. Liversage, Agricultural Economics Research Institute, University of Oxford. Clarendon Press, Oxford, 1926. 2s.

PRELIMINARY REPORT OF AN INVESTIGATION INTO THE ARTIFICIAL DRYING OF CROPS IN THE STACK. Institute of Agricultural Engineering, University of Oxford. Clarendon Press, Oxford, 1926. 2s. 6d.

INTERNATIONAL YEARBOOK OF AGRICULTURAL LEGISLATION, 1926 (covering year 1925). Published by the International Institute of Agriculture, Rome. 12s. 6d.

INTERNATIONAL YEARBOOK OF AGRICULTURAL STATISTICS FOR 1925–26. Published by the International Institute of Agriculture, Rome. 100 lire, or English money equivalent at current rate of exchange.

CHEMISTRY FOR AGRICULTURAL STUDENTS. By R. H. Adie, Lecturer in Physics and Chemistry, School of Agriculture, Cambridge. University Tutorial Press (Limited), London. 5s. 6d.

THE DAIRY INDUSTRY AMENDMENT ACT, 1926.

1. This Act may be cited as the Dairy Industry Amendment Act, 1926, and shall be read together with and deemed part of the Dairy Industry Act, 1908 (hereinafter referred to as the principal Act).

Remedying Defects.

2. Section six of the principal Act is hereby amended by adding the following paragraph: "(*aa.*) That any dairy-produce produced in or stored on any dairy is likely to be contaminated by reason of any structure or other thing situated in the neighbourhood of the dairy, or of any operations carried on or of any conditions obtaining in the neighbourhood thereof."

Apportionment of certain Expenditure between Landlord and Tenant.

3. (1.) In the case of a farm where the relationship of landlord and tenant exists between the owner and the actual occupier thereof the following provisions as to the apportionment of the expenditure shall, in the absence of an express agreement to the contrary, apply where expenditure on buildings or other permanent improvements of the farm is rendered necessary by reason of an order of an Inspector made pursuant to sections six and seven of the principal Act: (*a*) If the interest of the tenant at the time the expenditure is incurred is for a term of not more than two years and six months the whole of the expenditure shall be borne by the landlord; (*b*) if the interest of the tenant at the time the expenditure is incurred is for a term exceeding two years and six months the tenant shall pay a sum equal to five per centum of the total expenditure for each year of the unexpired term of his interest, and the landlord shall pay the balance, if any. If the term includes a broken period, and such period exceeds six months, it shall count in the computation as one year, but otherwise shall not be counted: Provided that, in either of the cases aforesaid, if the business of dairying has not previously been carried on on the farm and the tenant commences such business without the consent in writing of his landlord the tenant shall bear the whole of the expenditure.

(2.) If any landlord or tenant pays more than his proper proportion hereunder of such expenditure he may recover the excess from his tenant or landlord (as the case may be) as a debt due to him, and any tenant may set off any sum recoverable by him under this subsection against any rent payable to his landlord.

(3.) Where an order involving expenditure to which the provisions of this section will apply is served on a tenant, he shall forthwith forward a copy thereof to the landlord; and if the tenant incurs any expenditure without taking such action as aforesaid the landlord shall not be liable to make any contribution towards the expenditure in terms of this section.

(4.) A copy of this section shall be printed on every such order as aforesaid.

Certain Nuisances not allowed near Dairy.

4. Section twelve of the principal Act is hereby amended by omitting from subsection one the words "A person shall not keep pigs or permit them to be kept," and substituting the words "A person shall not keep, house, or pen pigs, or permit them to be kept, housed, or penned, or to wander or be brought."

Cooling of Milk or Cream.

5. Section sixteen of the principal Act is hereby amended as follows: (*a*) By omitting the words "by being passed over a cooler or aerator," and substituting the words "in manner prescribed"; and (*b*) by adding the words "and a person shall not supply or sell to any dairy any cream unless such cream has been properly cooled, in manner prescribed, immediately after being separated."

Butter containing less than 80 per Centum of Butterfat not to be exported.

6. (1.) Paragraph (*d*) of subsection one of section twenty-two of the principal Act (as set out in subsection one of section two of the Dairy Industry Amendment Act, 1915) is hereby amended by inserting, after the words "more than sixteen per centum of water," the words "or less than eighty per centum of butterfat."

(2.) Subsection two of section two of the Dairy Industry Amendment Act, 1915, is hereby consequentially amended by inserting, after the words "more than sixteen per centum of water," the words "or less than eighty per centum of butterfat."

Differential Prices for Different Grades of Milk and Cream.

7. The power conferred by the principal Act to make regulations is hereby extended to include power to make regulations requiring owners of dairy factories to pay different prices for different grades of milk or cream supplied to such factories for manufacture, and fixing the minimum amounts by which the prices shall vary for the different grades. Regulations in regard to the grading of cream may provide for a classification of cream according to the percentage of butterfat therein, and the power herein contained to require the payment of different prices according to grade and to fix the minimum variation in the prices shall extend to include a power to require the payment of different prices according to the classification of the cream, and to fix the minimum variation in such prices.

Dairy Companies not to describe themselves as Co-operative unless actually so.

8. (1.) No company which has for its object or one of its objects the manufacture of butter, cheese, dried milk, casein, or other article from milk or cream, or the collection, treatment, and distribution for human consumption of milk or cream, shall be registered under the Companies Act, 1908, under any name which includes the word "co-operative" or any word of like significance unless it is entitled to be registered as a co-operative dairy company under Part III of the principal Act.

(2.) At any time after the first day of April, nineteen hundred and twenty-seven, the Registrar of Companies may by notice call upon any such company as aforesaid heretofore registered under the Companies Act, 1908, under a name signifying that it is co-operative in character but which is not entitled to be registered under Part III of the principal Act, or upon any company so named the registration of which under the said Part III has at any time been cancelled, to take steps to change its name so as to remove therefrom the signification that it is a co-operative dairy company, and the company shall not later than one month from the date of the notice from the Registrar take the appropriate steps under the Companies Act, 1908, to effect the change of its name.

(3.) After the first day of April, nineteen hundred and twenty-seven, it shall be the duty of every company which is registered under Part III of the principal Act, or which is entitled to be so registered, and of every company to which the last preceding subsection applies, at all times until it has changed its name as required by that subsection, to furnish to every person (not being a shareholder of the company) engaged in supplying milk or cream to the company a copy of every account, report, or balance-sheet which by virtue of its articles or otherwise it is required to furnish to its shareholders, in the manner and within the times prescribed in respect of shareholders

(4.) If any company fails for thirty days to comply with the provisions of the last preceding subsection the chairman and every director thereof shall be severally liable to a fine of ten pounds.

KILLINGS AT MEAT-WORKS, SEASON 1925-26.

STATISTICS issued by the Meat Producers Board show the total killings at meat-works in New Zealand for the frozen-meat industry year, 1st November, 1925, to 31st October, 1926, as follows:—

Class.	North Island.	South Island.	Dominion.	Dominion, Season 1924-25.
Lamb (carcases)	2,375,318	2,625,272	5,000,590	4,750,164
Wether mutton (carcases) ..	1,071,592	152,162	1,223,754	1,271,221
Ewe mutton (carcases) ..	514,631	262,955	777,586	953,042
Beef (quarters)	211,619	3,975	215,594	458,549
Pork (carcases)	60,613	144	60,757	35,753
Boneless beef (freight carcases)	189,663	33,752	223,415	263,738
Sundries (freight carcases) ..	97,571	13,658	111,229	54,961

LIVE-STOCK IN NEW ZEALAND, 1926.

Unless otherwise specified, the enumeration is at 31st January.

Land District.	Horses.	Asses and Mules.	Cattle (including Dairy Cows).	Dairy Cows.		Number of Sheep shorn, 1925–26.	Number of Lambs tailed, 1925–26.	Sheep (including Lambs) as at 30th April, 1926.	Pigs.	Goats.	
				In Milk.	Dry.					Angora.	Other.
North Auckland ..	35,685	50	477,098	179,768	21,393	767,010	332,113	818,202	72,302	631	1,871
Auckland	45,960	2	705,656	308,992	22,511	980,596	494,173	1,010,809	132,320	821	2,451
Gisborne	19,273	51	339,447	26,889	5,258	2,838,744	1,251,762	2,976,255	13,641	315	1,657
Hawke's Bay ..	16,487	4	246,427	46,446	8,311	2,739,414	1,366,978	2,916,689	16,849	1,043	1,776
Taranaki	20,873	1	374,184	193,929	11,155	813,093	367,734	787,077	57,828	284	4,076
Wellington	41,942	22	681,392	180,957	20,780	5,113,742	2,532,458	5,408,119	72,716	621	703
Nelson	7,386	3	65,692	25,847	3,777	365,691	134,274	422,459	14,658	696	1,067
Marlborough	7,161	..	45,681	15,553	1,994	961,388	406,876	1,040,063	7,179	314	3,057
Westland	2,422	1	42,207	10,997	2,253	57,836	38,500	63,137	5,865	27	48
Canterbury	58,790	10	187,054	76,060	9,647	4,019,996	2,390,863	4,711,837	48,370	182	96
Otago	33,330	13	128,773	50,243	7,968	2,629,328	1,298,478	3,121,881	19,615	11	9
Southland	25,558	4	158,875	65,760	7,368	1,398,862	821,571	1,628,465	11,191	..	5
Dominion totals ..	314,867	161	3,452,486	1,181,441	122,415	22,686,200	11,435,780	24,904,993	472,534	4,945	16,816
Totals 1925 (or 1924-25)	326,830	190	3,503,744	1,195,567	127,865	22,335,528	11,467,147	24,547,955	440,115	5,696	13,279

CROP AREAS AND YIELDS: SEASONS 1924-25 AND 1925-26.

Crop.	1924-25.		1925-26.	
	Area.	Yield per Acre.	Area.	Yield per Acre.
Wheat—	Acres.		Acres.	
Grain	166,964	32·62 bushels	151,673	30·44 bushels.
Chaff, &c.	1,105	1·59 tons	857	1·35 tons.
Oats—				
Grain	147,387	38·72 bushels	102,485	40·14 bushels.
Chaff, &c.	308,527	1·64 tons ..	245,026	1·45 tons.
Barley—				
Grain	25,138	31·75 bushels	25,969	36·47 bushels.
Chaff, &c.	242	1·64 tons ..	370	2·14 tons.
Maize—				
Grain	8,621	49·47 bushels	8,508	49·75 bushels.
Ensilage	600	4·02 tons ..	557	3·01 tons.
Peas and beans ..	14,027	29·27 bushels	11,749	24·48 bushels.
Linseed—Seed ..	6,679	0·32 tons ..	8,143	0·29 tons.
Rye-grass—Seed ..	66,764	452·34 lb. ..	45,154	456·77 lb.
Cocksfoot—Seed ..	12,254	150·39 lb. ..	9,745	173·90 lb.
Chewings fescue—Seed	4,459	268·69 lb. ..	6,902	228·12 lb.
Crested dogstail—Seed	1,969	198·42 lb. ..	2,679	174·96 lb.
Red clover and cow-grass—Seed	10,400	159·92 lb. ..	6,579	185·16 lb.
White clover—Seed ..	3,196	151·73 lb. ..	5,358	176·13 lb.
Other grasses and clovers —Seed	4,113	272·12 lb. ..	3,132	153·55 lb.
Grasses and clovers cut for hay	229,644	1·83 tons ..	224,777	1·76 tons.
Potatoes	23,092	5·27 tons ..	23,484	6·09 tons.
Green fodder crops ..	240,061	..	255,429	..
Turnips	452,894	..	468,475	..
Mangolds	15,111	..	13,296	..
Onions	548	9·90 tons ..	514	8·73 tons.
Hops	744	1,542·57 lb. ..	648	1,159·59 lb.

IMPORTATION OF SEEDS FROM THE UNITED STATES.

EARLY in 1924 outbreaks of foot-and-mouth disease in the United States of America made it necessary that precautions should be taken against the introduction of the disease into New Zealand. To this end regulations were made prohibiting the importation of products of the soil from the States of California, Washington, Oregon, and Texas. The disease having since been stamped out in the affected regions it was considered safe to modify the regulations. The prohibition has therefore been revoked in so far as it relates to products other than seeds. It has been deemed necessary to continue the prohibition of the importation of flower, vegetable, grass, clover, and tree seeds (but not grain) which, being the produce of California or Texas, were harvested prior to 1st April, 1926. Further, to ensure that such seeds are not imported, consignors' certificates of origin are required to accompany each consignment of seeds from the United States. In the case of seeds grown in States other than California or Texas it is sufficient that certificates should show the State in which the seeds were grown, but for seeds from these two States this certificate must be supplemented by a statement that they were not harvested prior to 1st April, 1926.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

TREATMENT OF HORSES FOR WORMS.

E. J. PERRY, Waihao Downs :—

I should be glad if you would give information as to best treatment for a horse that has red worms.

The Live-stock Division :—

There are several species of parasites affecting horses, but no doubt the ones to which you refer belong to the *Sclerostomum* family. These in the adult stage infest the cæcum and colon, but during their life-history undergo several changes. One species passes its larval stage in the walls of the intestines, and another in the walls of blood-vessels. Any treatment, therefore, to be successful needs repetition at intervals, in order to reach these larvæ when they mature. The following treatment has been found very effective: Remove the horses from damp and infected pastures, and feed on nutritious dry feed; then give two or three bran mashes, following which the animals should be allowed to fast for twenty-four hours. After this the following mixture is given: Oil of chenopodium, 4 drams; linseed-oil, 1 quart. This is the dose for a full-sized aged draught horse. Smaller doses of chenopodium would be necessary for younger and smaller horses. Of course, prevention is preferable to treatment. The ova or eggs of these parasites are voided in the fæces and are hatched out on the ground, where the larvæ can remain for long periods—especially in damp places. They can enter their host along with the feed, which thus becomes contaminated. Where trouble of this nature has occurred and the ground is possibly infested, it is advisable (1) to remove the horses (especially young ones) on to dry pastures; (2) to feed them on nutritious fodder obtained from dry pastures; (3) to allow the animals to fast for from twelve to twenty-four hours and then give the following: Hydrarg. subchlor., 1 dram; antim. potass. tartrate, 1 dram; ferri sulph., 2 drams; pulv. aloes, 2 drams; Saponis mollis, sufficient to make a ball: one to be given to each horse every two months. It would be necessary for a chemist to mix this up for you. Young and small horses would require smaller doses. Another form of red worm is found in the rectum, and an injection of vinegar and soapy water followed by a drench of turpentine, 1 oz., and linseed-oil, 1½ pints, has been successful.

CLEARING AND GRASSING MANUKA AND GORSE AREA.

J. B. RAMWELL, Okoia :—

I have a steep hillside carrying manuka and patches of gorse, and am having the gorse grubbed now. Would it be better to cut the manuka this summer and burn in the autumn, or to cut the manuka in twelve months' time and give the gorse-seed time to germinate before burning? The face is heavy clay with very little depth of earth, and is inclined to be shady. The total area is about 60 acres. What would be a good grass mixture to sow after the burn? Would paspalum be suitable?

The Fields Division :—

If there is much gorse it would be advisable to let it lie over the season, then cut the manuka next summer, and burn the whole the following March, taking care that the land is thoroughly dry, so as to ensure a good fire to destroy the manuka-seed. This will give the gorse a good check. If there are only small patches of gorse the manuka may be cut this season and the whole burnt in March, as suggested above. Sowing should take place immediately after the burn, and, if possible, before the ashes have been wetted by rain. Paspalum does not thrive very well on the dark faces in your district, but is useful on the more open warm faces. The following

mixture per acre is recommended: Italian rye-grass, 3 lb.; perennial rye-grass, 8 lb.; crested dogstail, 4 lb.; brown-top, 1 lb.; Danthonia pilosa, 2 lb; paspalum, 1 lb.; white clover, 1 lb.; Lotus major, ½ lb: total, 20½ lb. If your land is already carrying a fair amount of danthonia this may be omitted from the mixture.

DESTROYING HEMLOCK.

"ORCHARDIST," Ettrick:—

What is the best method of killing hemlock, or carrot-fern? Can it be killed by spraying with bluestone, and, if so, what strength should be used? Is there any other cheap weed-killer that can be used in the orchard-sprayer capable of killing hemlock?

The Horticulture Division:—

The best way to destroy hemlock-plants is to cut them off with a sharp implement of any kind well below the surface of the ground—early in the New Year for preference. Like the carrot and parsnip, hemlock is a biennial plant which, after growing for two seasons, produces a crop of seed and dies. Owing to its poisonous nature the cut plants when wilted should be gathered and placed out of reach of stock. To use a weed-killer in the orchard spray-pump, as you suggest, is undesirable, owing to the possibility of burning the fruit-trees afterwards.

SOW FAILING TO BREED.

C. E. NICHOLSON, Motueka:—

I have a young purebred Berkshire sow that has repeatedly returned to the boar. Although she had one litter of pigs about two years ago she has failed to breed since. Would you please advise me what to do?

The Live-stock Division:—

In this instance it is difficult to state what the actual cause of sterility might be. Very frequently sterility in sows is brought about by a too fat condition of the animal, and it is always worth while to try the effect of a diet leading to considerable reduction in condition. You do not mention if the sow shows any signs of discharge. Inflammation of the womb is occasionally a cause of sows not breeding. Treatment is difficult, but irrigation of the womb with a very weak solution of Condy's crystals in water might be tried. It is also advisable in these cases to change the boar.

FEEDING MAIZE TO PIGS.

E. ATKINSON, Te Puke:—

I fed whole maize-corn to my pigs, and noticed it went through them whole. I then gave it crushed, but it passed through them the same size as when fed. Kindly tell me the most profitable way to feed maize.

The Live-stock Division:—

Maize is an excellent food for pigs when given in conjunction with skim-milk, but, owing to the fact that it is deficient in mineral matter and less so in protein, it is not a suitable grain to be fed alone. The best way to feed maize to growing pigs is to throw the cobs to the pigs and let them pick off the grain, or to scatter the grain on to a clean concrete floor or dry yard and allow the pigs to pick up each grain separately. In either of these ways the pig will masticate the grain and be able to digest and assimilate the food. If neither of these methods can be carried out satisfactorily the next best way is to feed the maize as meal in the dry state by means of a self-feeder, or by giving the meal twice daily in the trough after the milk. Maize-meal should not be fed in the usual swill, but, if desired to soften it, it may be soaked for a few hours and given in a little liquid so that the mixture has a consistency like that of soft porridge. Similarly, the grain may be soaked for twelve hours and then fed by itself. The daily ration of maize for pigs varies from 1 lb. to 3 lb. for every 100 lb. weight of pig, and according to the age of the animal.

ESTIMATES OF THE SEASON'S LAMBING.

FOLLOWING are complete estimates of the current season's lambing, computed from estimated average percentages furnished by Inspectors of Stock in the various districts. Corresponding figures for the five previous years, together with the actual numbers of lambs tailed, are also given for comparison.

Year.	Number of Breeding-ewes.	Estimated Average Percentage of Lambing.	Estimated Number of Lambs.	Actual Number of Lambs tailed.
		NORTH ISLAND.		
1926 ..	7,503,200	84·35	6,329,338	..
1925 ..	7,463,735	85·64	6,391,812	6,345,218
1924 ..	7,148,949	85·00	6,049,654	6,199,881
1923 ..	7,170,154	91·34	6,549,143	6,170,673
1922 ..	6,771,482	90·36	6,118,530	5,955,081
1921 ..	6,312,456	89·65	5,659,355	5,457,643
		SOUTH ISLAND.		
1926 ..	6,445,052	84·79	5,465,361	..
1925 ..	6,251,488	78·61	4,914,046	5,090,562
1924 ..	5,927,145	87·87	5,208,378	5,267,266
1923 ..	5,892,849	83·99	4,949,313	4,962,663
1922 ..	5,724,572	82·53	4,724,475	4,949,440
1921 ..	5,835,332	83·28	4,895,425	4,810,258
		DOMINION.		
1926 ..	13,948,252	84·57	11,794,699	..
1925 ..	13,715,223	82·43	11,305,858	11,435,780
1924 ..	13,076,094	86·14	11,258,032	11,467,147
1923 ..	13,063,003	88·02	11,498,456	11,133,336
1922 ..	12,496,054	86·77	10,843,005	10,904,521
1921 ..	12,147,788	86·59	10,518,780	10,267,901

—*Live-stock Division.*

FIREBLIGHT ACT REGULATIONS.

REGULATIONS under the Fireblight Act, 1922, gazetted on 25th November, create two new commercial fruitgrowing districts—namely, Whangarei and Gisborne. Such districts are subject to measures that may be prescribed for dealing with hawthorn in the respective areas. Details of the boundaries of the new districts are given in the *Gazette*.

ARGENTINE EMBARGO ON NEW ZEALAND FRUIT.

IN December, 1925, owing to the alleged presence of Mediterranean fruit-fly in the Dominion, the Argentine Government prohibited the importation of New Zealand fresh fruit and vegetables into Argentina, this principally affecting the trade in apples. Owing to representations made the embargo was provisionally lifted last January, and it has now been definitely removed. This decision is taken to be the result of the favourable report given by Messrs. Trelles and Blanchard, the Argentine officials who visited New Zealand last summer.

Eggs and Egg-pulp in Cold Storage.—The quantities returned as at 31st October, 1926, are as follows: Eggs in shell—North Island, 9,435 doz.; South Island, 14,510 doz.; Dominion, 23,945 doz. Egg-pulp—North Island, 331,083 lb.; South Island, 120,662 lb.; Dominion, 451,745 lb.